

ELECTRICAL REVIEW

LONDON: HAUGHTON & COMPANY, 10, PATERNOSTER ROW, E.C.
 NEW YORK: D. VAN NOSTRAND, 25, Murray Street, and 97, Warren Street. PARIS: M. BARRON, 35, Rue de Valenciennes; Madame Veuve J. BOUTIER, Librairie d'Anglais, 22, Rue de la Harpe. BERLIN: A. ARNDT & Co., 2, Unter den Linden.

JOHNSON & PHILLIPS, TELEGRAPH ENGINEERS, ELECTRICIANS, AND CONTRACTORS.

OFFICE: 16, UNION COURT, OLD BROAD STREET, LONDON, E.C.

WORKS: VICTORIA ROAD, CHARLTON, LONDON, S.E.

Manufacturers of all Telegraph Appliances, Materials and Machinery for Making and Laying Submarine Cables, and Contractors for Underground & Aerial Telegraphs.

Iron and Steel Telegraph Buoys, Grappels, both Patent and Ordinary; Centipeds, Creepers, Mushrooms, Sunkers, Cable Tanks, Picking-up and Paying-out Machinery, Dynamometers, Bow and Stern Gear, Steam and Hand Hauling Gear, Rope and Chain Fittings, Cable Drums, Splicing and Jointing Tools, &c., &c.

Machinery Designed and Constructed for the Complete Equipment of Telegraph Cable Factories and Vessels. Wire Testing Machines for Tension, Elongation, and Torsion. Special Wire Bounding Machines for Shallow and Deep Water.

All Apparatus and Material used in the Construction and Maintenance of LAND LINES, viz.:

INSULATORS—Johnson & Phillips' Patent Fluid Insulators, and all kinds of the ordinary form, Shockles, Shockle Staps, &c.

BATTERIES—Sole Makers of Higgins' Patent Bichromatic Batteries, and all the ordinary forms. Contractors for the supply of Zinc and Carbon Battery Plates of special quality.

POLES—Wrought Iron or Composite Poles of various kinds, for Telegraph, Telephone, and Electric Light purposes.

Makers of Special Underground Torpedo and Field Cables, with Single or Multiple Cores.

Insulated Copper Wire, Strand and Ropes, tinned or braided, cotton or silk covered.

ELECTRIC LIGHT—Makers of Brockie's Electric Lamp.

Every description of Leading WIRES and CABLES. CARBON RODS, both Black and Coppered.

SOLE MAKERS OF VYLE'S PATENT EASILY TESTED LIGHTNING CONDUCTORS.

HOOVER'S TELEGRAPH & INDIA RUBBER WORKS.

OFFICES:—81, LOMBARD STREET, LONDON, E.C. WORKS:—MITCHAM AND MILLWALL DOCK.

MANUFACTURERS OF SUBMARINE AND SUBTERRANEAN TELEGRAPH CABLES

UNDER HOOVER'S PATENTS

MEDAL
OF
PROGRESS
1876



CONTRACTORS TO
HIS MAJESTY'S WAR OFFICE,
ADMIRALTY AND INDIA OFFICE,
AND TO THE CONTINENTAL GOVERNMENTS.



GOLD
MEDAL
1881

ELECTRIC LIGHT WIRES.

THE "PILSEN" JOEL AND GENERAL ELECTRIC LIGHT COMPANY, LIMITED.

PATENTERS AND MANUFACTURERS OF
THE PILSEN ARC LAMP, THE JOEL SEMI-INCANDESCENT LAMP,
AND THE GATEHOUSE INCANDESCENT LAMP.

Manufactory: THE MALDEN FACTORIES, KENTISH TOWN, N.W.,
H. P. JOEL, A.M.I.C.E., Engineer.

E. T. GREGORY, Secretary.

JAMES FIFE, Managing Director.

TEMPORARY OFFICES—82, QUEEN VICTORIA STREET, E.C.



Contractors to H.M. Postmaster-General, the Indian Government, the principal
Railway, Telephone, and Electric Light Companies.

ESTABLISHED 1868.

WALTER T. GLOVER & Co.,
Telegraph Wire and Cable Makers,
25, BOOTH STREET, MANCHESTER.

INDEX TO THE TELEGRAPHIC JOURNAL AND ELECTRICAL REVIEW ADVERTISEMENTS.

No charge is made for inserting the Names of firms whose advertisements are ordered for a series of insertions in this Journal during the continuance of such advertisements.

(The numbers refer to the page on which the displayed advertisement will be found.)

Colliery Work.	PAGE	Engines for Electric Light.	PAGE	Publications.	PAGE
G. Beach	3	Peter Brotherhood	6	"Electrician"	9
W. M. Foxworth	3	Globe for Electric Light.	6	"Railway Supplies Journal"	9
Clock Synchronising.		G. Houghton & Son	3	Screens.	
Barrett & Lunt	6	Insulators.		Davis & Timmins	12
Educational.		Bourne & Co.	5	International Machine Company	4
Hammond Company Electrical Engi- neering College	8	David Brooks	5	Telephones.	
School of Telegraphy	9	G. Johnson & Sons	4	W. C. Barney	12
Electrical Engineers and Contractors.		Sill & Sons	4	Blakely, Ramsell & Co.	6
Callender's Bitumen Telegraph, &c., Co.	7	Lighting Conductors.		Harrison, Cox-Walker & Co.	10
W. T. Huxley	5	Naval & Co.	12	Swiss Telephone Company	11
Hooper & Co.	1	Machinery.		M. Thellier & Sons	6
India-rubber and Telegraph Works Co.	13	Thos. Barradough & Co. (Limited)	5	Wood Engraver.	
Johnson & Phillips	1	Manufacturing Electricians.		E. A. Chadless	4
K. Paterson	13	T. Compton & Co.	4	Wire (covered).	
Electric Light.		H. & E. J. Dale	4	W. T. Glover & Co.	3
J. Hammond & Co. (Swan)	5	J. T. Goss & Co.	4	London Electric Wire Company	10
Edison Electric Light Co., Limited	7	J. Goss & Co.	5	Phillips Brothers	10
Griffith & Co.	4	E. A. Stevens	5	Wire (uncovered).	
Pilsen-Joel and General Electric Light Company, Limited	2	Patent Agents.		Cooke & Co.	5
Electric Motor.		E. F. Alexander	6	R. Johnson & Wapner	8
Electro Dynamic Co.	9	H. Gardner	5	Ramsden, Camm, & Co.	7
		Patent Glass Research.		F. Smith & Co.	9
		"B. L."	9	Webster, Horsfall & Lunn	10
		Barry Collis.			
		J. Sill & Sons	4		

THE TELEGRAPHIC JOURNAL AND ELECTRICAL REVIEW.

VOL. XI.

JULY 29, 1882.

No. CCXLIV.

CONTENTS:

	PAGE		PAGE
The Electric Lighting Bill	63	New Patents—1882	73
The Chemistry of the Planté and Faure Cell	64	Abstracts of Published Specifications	73
Harrison, Cox-Walker, and Co.'s Telephone Call (<i>illustrated</i>) ...	65	City Notes:—	
Haskins' Arc Electric Lamp (<i>illustrated</i>)	66	The Metropolitan (Brush) Electric Light and Power Co. ...	76
Correspondence:—		The Electric Lighting and Maintenance Company.....	77
The Telephone	69	The India-Rubber, Gutta-Percha, and Telegraph Works Co. ...	79
Carbonising Processes	69	The European, American, Canadian, and Asiatic Cable Co. ...	79
The Crystal Palace Electrical Exhibition	69	Globe Telegraph and Trust Company	79
Notes (<i>illustrated</i>)	69		



PATENT OFFICE.
H. GARDNER,
166, FLEET STREET,
LONDON.

Successor to
Messrs. ROBERTSON, BROOMAN & Co.,
Gives prompt personal attention, and ob-
tains Patents for Inventions, Protection
for Trade Marks, &c., at fixed and moderate charges.

PAMPHLET OF COSTS GRATIS.
Thirty Years' Practical Experience.
Provisional Protection, £8.

RICHARD JOHNSON & NEPHEW,
MANCHESTER.
TELEGRAPH AND TELEPHONE LINE WIRE.
LONDON OFFICE:
8, GREAT WINCHESTER STREET, E.C.

GEORGE BEECH,
Telegraph Instrument Case Manufacturer
by Steam Power,
109, DALSTON LANE,
KINGSLAND.

Railway and Telegraph Engineers supplied with every
description of Telegraph Instrument Cases, Single Needle,
Block, Bell, Switch, &c. The material and workmanship of
first quality and guaranteed. (Established 1872.)
Drawings for New Designs got out for approval.

F. A. STEVENS,
Electric Bells and Batteries Manufactured, Wholesale and Retail.
63, WEST SMITHFIELD, E.C.
Price List Free.

GEO. HOUGHTON & SON,
89, HIGH HOLBORN, W.C.,
MANUFACTURERS OF ALL KINDS OF
GLASS GLOBES, &c.,
FOR
ELECTRIC LIGHTING.

FREDERICK SMITH & Co.,
Contractors to H.M. Postmaster-General,
CALEDONIA WORKS, HALIFAX, ENGLAND.

SPECIALITIES:
PATENT GALVANISED

Galvanised Strand Wire.
Stay Wire (*special*).
3/16 Strand High Conductivity.
Patent Galvanised Binding Wire.
Line Wire to all Specifications.



Cable Wire.
Patent Steel Wire for Hawser and
Deep-Sea Sounding Lines.
Galvanised Patent Steel Wire for
Long Spans.

WITHOUT JOINT OR WELD.

Prize Medals:—London, 1862; Paris, 1867; Moscow, 1872; Vienna, 1873; Paris, 1878; Philadelphia, 1876.

TELEGRAPH CABLE MAKING MACHINERY

Suitable for every description of Cables (Land and Submarine).

WIRE STRANDING MACHINES

For making Telegraph Strand with any number of wires from 3 to 19.

CORE SERVING MACHINES of all sizes.

TAPING MACHINES, Single and Double.

WIRE COVERING MACHINES of every description for covering wire with india-rubber, gutta-percha, hemp, flax, cotton, silk, &c.

COMPLETE SETS of Machine for purifying and preparing INDIA-RUBBER and GUTTA-PERCHA for Telegraphic purposes.

Estimates furnished on application. For Plans of Works a fee is charged proportionate to the labour involved.

THOMAS BARRACLOUGH & Co., Limited, 8, King Street, Manchester.

GRIFFITH & Co.,

(Late Harborow & Co.),

ELECTRIC LIGHT ENGINEERS,

AND

TELEGRAPH INSTRUMENT MANUFACTURERS,

4, QUEEN ANNE'S GATE, S.W.

G. JOHNSON & SON,

IMPORTERS AND REFINERS OF

PARAFFINE WAX

Of high melting point, and prepared with special regard to Insulating Property.

BLACK EARTH WAX, CRUDE AND REFINED.

BEES' WAX, YELLOW AND BLEACHED.

Stearine, Spermaceti, &c., at lowest Wholesale rates.

175, BISHOPSGATE ST. WITHOUT, 175
LONDON.

ELECTRICAL & SCIENTIFIC APPARATUS.

Manufacturers of Electric Bells, Indicators, Constant Batteries, Telephone Switches and Transmitters, Induction Coils, Terminals, Carbons, Wires, &c.

COMPLETE CATALOGUE, TWO STAMPS.

THOMAS CRAMPTON & CO.,
MANUFACTURING ELECTRICIANS AND OPTICIANS,
251, HIGH HOLBORN, LONDON, W.C.

ELECTRICAL & SCIENTIFIC APPARATUS.

WHOLESALE MANUFACTURERS OF

ELECTRIC BELLS, ELECTRIC REVERSING INDICATORS,

"ARC" LAMPS,

TELEPHONE SWITCHES & TRANSMITTERS,

New "Granule" Battery, Constant and Powerful Coils, Vacuum Tubes, Terminals, Carbons, Wire, and all Materials.

INSTRUMENTS MADE, REPAIRED, OR ALTERED ON THE PREMISES.

New Edition, complete Illustrated Catalogue of Electric Appliances and Materials, 72 pp., post free four stamps.

SPECIAL QUOTATIONS TO THE TRADE.

H. & E. J. DALE,
Manufacturing Electricians, 4, Little Britain, London, E.C.



THE INTERNATIONAL MACHINE COMPANY,

MANUFACTURERS OF ALL KINDS OF

SCREWS IN IRON, STEEL, OR BRASS.

Telegraph and Telephone Work.

BINDERS, TERMINALS, CLAMPS, &c.

Turned or shaped parts for Dynamo and Magneto Machines.

OFFICE—118, WHITEHORSE ST., COMMERCIAL RD., LONDON, E.C.

PRIZE MEDAL, PARIS ELECTRICAL EXHIBITION, 1881.



J. STIFF & SONS,

LAMBETH, LONDON,

MANUFACTURERS OF

POROUS CELLS AND PLATES,

BATTERY JARS,

TELEGRAPH INSULATORS,

Chemical Apparatus, Art Stoneware,

PLUMBAGO CRUCIBLES, &c.

Contractors to the Post Office and other Departments.

J. T. GENT & Co.,

LEICESTER,

Manufacturers of
ELECTRIC, PNEUMATIC,
and ELECTRO-PNEUMATIC
BELLS and PENDULUMS,

Mining Signals, Lightning Con-
ductors, Insulated Wires of every
description.

RAILWAY TELEGRAPH STORES.

Batteries, Pushes, and other
Electrical Apparatus.



Estimates given and Contracts
taken for all kinds



of Newspaper and Commercial
Work.

W. T. HENLEY'S TELEGRAPH WORKS CO.,
LIMITED,
TELEGRAPH ENGINEERS & CONTRACTORS.

MANUFACTURERS OF SUBMARINE CABLES
AND TELEGRAPHS OF ALL KINDS.

TELEGRAPH WIRES AND STORES OF EVERY DESCRIPTION.

8, Draper's Gardens, Throgmorton Street, London.
WORKS—NORTH WOOLWICH.

JOSEPH BOURNE & SON,
MANUFACTURERS OF THE WELL-KNOWN
STONEWARE TELEGRAPHIC INSULATORS AND BATTERY JARS.

For Thirty years these manufactures have been celebrated for a high degree of vitrefaction combined with great toughness and strength.

Brown Stoneware. White Stoneware. Brown Porcelain. Porous Cells.

Economy, Strength, and Durability combined.

Prize Medal, Paris Electrical Exhibition.

Works: DENBY POTTERY, NEAR DERBY.

London Office: 6, ST. PANCRAS STATION, EUSTON ROAD, N.W.

THE BROOKS' PATENT INSULATORS
WERE AWARDED THE FIRST PREMIUM

At the PARIS EXPOSITION of 1867, at the VIENNA EXPOSITION, 1873, at the CINCINNATI INDUSTRIAL EXPOSITION in 1874, and at the CENTENNIAL EXPOSITION at PHILADELPHIA in 1876.

These INSULATORS are being largely used by the WESTERN UNION and AMERICAN UNION TELEGRAPH COS.

MANUFACTURED AND FOR SALE BY

DAVID BROOKS,
22, SOUTH TWENTY-FIRST STREET, PHILADELPHIA.

THE "SWAN" INCANDESCENT LIGHT.

J. EDMUNDSON & CO., having been appointed as Agents in London for the Exhibition and Sale of the SWAN INCANDESCENT ELECTRIC LIGHT, are prepared to furnish Estimates for Supplying and Fitting up these Lamps complete, with all necessary apparatus.

J. EDMUNDSON & CO.,
ENGINEERS AND ELECTRICIANS,
19, GREAT GEORGE STREET, WESTMINSTER, S.W.



WM. COOKE & CO.,
LIMITED,

The TINSLEY STEEL, IRON, and WIRE WORKS,
SHEFFIELD.



SYDNEY EXHIBITION.

{ Award..... **FIRST DEGREE OF MERIT.**
 { Report..... **ALL ARTICLES OF SUPERIOR QUALITY,** as exhibited

by Sections of Bends and various Manufactures.

MELBOURNE EXHIBITION, 1880. FIRST AWARD FOR ALL EXHIBITS.

THE ONLY ENGLISH HOUSE WHICH OBTAINED A FIRST-CLASS AWARD FOR WIRE.

Bessemer Steel and Best Puddled and Charcoal Iron Rods, **GALVANISED TELEGRAPH and CABLE WIRE,** Steel and Iron Fencing and Strand Wire, Merchant Iron of all descriptions, and Best Homo. Yorkshire Iron for Engineering purposes. Telegraph Wire to British Government tests, in 100 lb. pieces, without weld or joint.

LONDON OFFICE, 110, CANNON STREET, E.C. MANCHESTER OFFICE, 3, SPRING GARDENS.

BARRAUD & LUNDS,**41, CORNHILL, E.C.**

PATENTED METHOD OF

SYNCHRONISING CLOCKS,

Which keeps invariably set to Mean Time all Clocks electrically connected.



THE FOLLOWING TELEGRAPH AND RAILWAY COMPANIES HAVE ADOPTED THE SYSTEM:—

EASTERN TELEGRAPH COMPANY.
ANGLO-AMERICAN TELEGRAPH COMPANY.
INDO-EUROPEAN TELEGRAPH COMPANY.
PARIS AND NEW YORK TELEGRAPH COMPANY.
GREAT NORTHERN TELEGRAPH COMPANY.

AMERICAN CABLE COMPANY.
GREAT EASTERN RAILWAY.
METROPOLITAN RAILWAY.
MIDLAND RAILWAY.
LONDON AND NORTH-WESTERN RAILWAY.

Provincial and Foreign Concessions arranged on terms to be obtained on Application.

OFFICE FOR PATENTS,
36, SOUTHAMPTON BUILDINGS, LONDON, W.C.

Mr. E. P. ALEXANDER,
Consulting Engineer and Patent Agent,

CONTINUES TO OBTAIN

BRITISH, COLONIAL, AND FOREIGN PATENTS FOR INVENTIONS.

M. THEILER & SONS,
MANUFACTURING ELECTRICIANS AND TELEGRAPH ENGINEERS,
86, CANONBURY ROAD, LONDON, N.

MANUFACTORY: 1, ALWYNE LANE, N.

SPECIALITIES: Inking Morses, Type Instruments, P. O. Standard Relays, Cable Relays,
Duplex and Quadruplex Apparatus, Fire Alarms, Electric Motors.

**TELEPHONE SWITCH BOARDS AND MAGNETO BELLS OF
SUPERIOR CONSTRUCTION.**

AWARDED GOLD MEDAL FOR TELEGRAPH INSTRUMENTS,
MELBOURNE INTERNATIONAL EXHIBITION, 1881.

PETER BROTHERHOOD,

MECHANICAL ENGINEER,

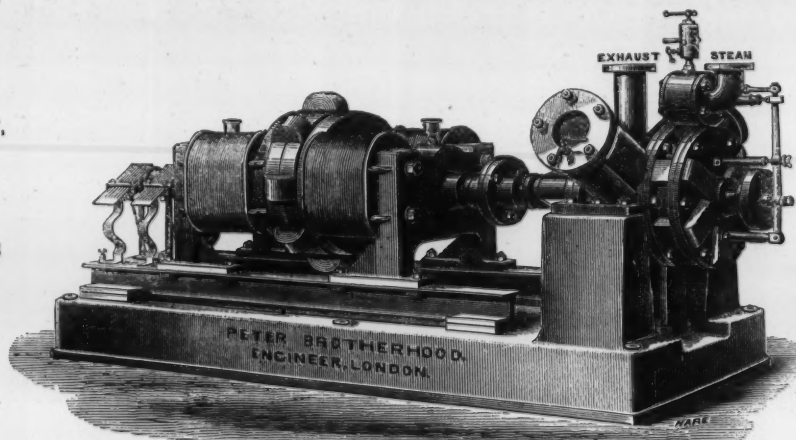
BELVEDERE ROAD, WESTMINSTER BRIDGE, LONDON, S.E.

PARIS, HENRY CHAPMAN, Esq., 10, Rue Laffitte.

PATENT 3-CYLINDER ENGINES,

AS SUPPLIED FOR DRIVING BRUSH DYNAMO-ELECTRIC MACHINES

Of 40 Lights,
to the
Steel Works of
Messrs. Bolckow,
Vaughan & Co.,
Middlesbro',
And of 16 Lights
to the
Royal Arsenal,
Woolwich;
H.M. Dockyard,
Chatham;



Of 16 Lights to
H.M.S.
"Inflexible,"
"Polyphemus,"
&c.;
SS. "Psara";
Messrs. A. Leslie
& Co.,
Hebburn-on-Tyne;
Great Western
Railway Co.'s
Station,
Paddington;
&c. &c.

Intending purchasers of high-speed Engines for driving Dynamo-Electric Machines of any class, or for other purposes, are invited to inspect the
BROTHERHOOD Engines in operation at the above address.

THE TELEGRAPHIC JOURNAL AND
Electrical Review.

VOL. XI.—No. 244.

THE ELECTRIC LIGHTING BILL.

THIS has formed the subject of a long and carefully worded letter from the pen of Sir Frederick Bramwell, published in the columns of the *Times* on Friday, the 21st inst. It was followed the next day by another epistle on the same matter, and bearing the signature of Robert Hammond, the well-known originator of the Hammond Electric Light Company. Both these communications are well worthy the serious consideration of all interested in the future prospects of the electric light, and we need scarcely say that the arguments of both gentlemen are entitled to careful thought.

In speaking of the compulsory sale of electric light undertakings at the end of fifteen years Sir Frederick says :—

The Electric Bill, by clause N of section 14, provides that where the lighting is done by an individual or by a private company, under a provisional order confirmed by an Act of Parliament, then at the end of fifteen years the local authority of the district lighted shall be entitled to say that it desires to purchase the undertaking, and thereupon the undertakers shall be compelled to sell. This in itself would be a sufficiently hard provision were the terms of payment fair; but the terms of payment are most unfair, for the arbitrator who, failing agreement, is to fix them is forbidden to take into account in so doing either past profits, goodwill (which means present profits), future profits, or any allowance for compulsory sale, and, having been thus told what he is not to allow, he is directed to ascertain the then value of the land, buildings, machinery, and plant, having regard to their suitability for the purposes for which they are intended; and this is to be the sole payment for the acquisition of the undertaking. Further, if the local authority should not choose to exercise this option at the end of fifteen years, then at each recurring period of five years the same option is to re-arise.

As I have said, there is nothing in the nature of electric lighting to justify exceptional harshness; on the contrary, it is regarded with approval, and thus, if there be any exceptions, it is to be supposed they would be exceptions in favour of this useful, desirable, but undeveloped industry. I fear the obvious conclusion to be drawn from the foregoing considerations is that in all future applications to Parliament for a Bill to light a town with gas, or to supply it with water, or to make a new railway from A to B, there will, in the interests of consistency, be inserted provisions that at the end of the fifteen years the local authority may buy the gas undertaking at the then value of the fifteen years' old pipes and fifteen years' old works, that it is to get the waterworks on similar terms, while the railway, extending over the districts of many local authorities, will be doomed to be acquired by the Government for the then value of the land, works, rails, and rolling-stock.

Sir Frederick makes out a very dismal prospect for the future development of any enterprise, but we scarcely think he is justified in comparing established undertakings such as waterworks or railways, the details of which are all known beforehand, with a practically undeveloped (as the writer admits) industry like the electric light. It is evident that Mr. Chamberlain had the public weal very much at heart when framing the clauses of his Bill.

Electric lighting has made vast progress of late years, but in an intermittent and partially unsatisfactory manner as far as the general public is concerned, for it is still a most difficult matter to get at the truth of the question of cost, as any report on the subject generally leaves something unmentioned, and the opponents of the electric light have

generally managed to get hold of some weak point in the arguments of its adherents. It is the general vagueness existing on this point of relative economy between the electric and other methods of illumination, and also the unscrupulous way in which much of the electric light business has been carried out, which probably induced Mr. Chamberlain to frame his Bill, so that electric lighting companies shall not receive more than fair returns for work done. We do not think that Sir Frederick Bramwell need fear that private enterprise in this country will be discouraged, and such undertakings pass into the hands of governing bodies. As a matter of fact, we need only mention the telephone, with which Sir Frederick has had so much to do. Instead of being monopolised the telephone industry has just been thrown open to all comers with certain restrictions, which we cannot imagine will be of a very severe nature. We believe with Sir Frederick that the making of governing bodies (generally) is a mistake, but surely we may rely on the good sense of Parliament to know where the line must be drawn. In the latter portion of his letter, the writer states :—

At the end of 15, 20, 25, and every period of five years after the 15, the local authority watches to see if there is a profit, and if there be, then it comes in and buys, not upon the profit, but upon the materials. If there is no profit, so that it would not be worth while to buy the materials in order to earn the income, then there is no obligation on the local authority to buy at all, and thus in effect the Bill says, "As long as there is no profit or a poor profit, you, the undertakers, may continue to work, but the instant you get anything like an adequate return, then we will come and buy you up at a price which must inevitably be a comparatively small fraction of the capital you have laid out in the undertaking." I feel compelled to repeat that which I told the committee, "This is a monstrous proposal."

It is on the foregoing grounds, I say, that the passing of this Bill must be looked upon as the beginning of the end of the carrying out of public enterprises by means of private capital.

This matter of profit or no profit depends almost entirely upon the management of the directorate of a company, and we do not see the force of Sir Frederick's argument that "as long as there is no profit, or a poor profit, you, the undertakers, may continue to work." We can quite understand the local authority as being anxious to buy a profitless concern at the end of a definite period, for the simple reason that under new management the undertaking might be made to yield a very fair return. Sir Frederick must know as well as any person in existence that the question of profit or no profit is usually a question of management. We have only to call his attention to a leading electric light company as an example of this. Others, probably, have electrical apparatus of as good, if not superior, nature, but that is not of much avail if the smartness of the directorate is absent. Mr. Hammond, who corroborates all the views expressed by Sir Frederick Bramwell, in one portion of his letter says :—

In erecting electrical apparatus in a town, a very large proportion of the outlay will be for labour in laying the mains, erecting the posts, fixing the wires, putting in the foundations, and making the connections with houses on the route. Now, if at the end of fifteen years, when the plant is turned over to the local authority, no value is to be placed upon this very important portion of the first outlay, then consumers, during the term allotted to the electric light company, must annually bear their proportion of these dead expenses; and it is therefore evident that unless the electric light company has a long term, I should say at least twenty-one years, the proportion of the dead expenses annually will be so heavy that the consumers would find the price charged for the electric light too onerous. If however the suggestion of Sir Frederick Bramwell were adopted, and the plant at the end of the term allowed to the electric light company were taken over upon its value as a going concern, then all the dead

expenses forming such a large proportion of the original outlay would be paid for by the local authority taking over the business, and would be quite fairly charged to them, since they would be forced to spend a like amount if they started *de novo* in their town.

Looking at the matter purely from a commercial point of view, being the one which my managing directorship of an electric light company daily presses upon me, I should say that the Bill with its present purchase clause is not sufficiently tempting to induce capitalists to put money largely into companies contemplated by the Act.

They will feel that the early consumers, though willing if necessary to pay more than the price of gas for the manifest advantages connected with the electric light, could not be fairly asked to bear the dead expenses which should always be considered as part of the capital, and not charged to revenue.

If, on the other hand, the clause is amended so that the local authority which elects to purchase pays for the electrical apparatus upon its value as a going concern, then an immense stride will have been made towards admitting the public to participate in the boon, as the result would be an immediate setting on foot of undertakings to supply the electric current from house to house.

In the meantime we cordially agree with both gentlemen that there is ample work and to spare of an isolated nature for all the electric light companies at present established; but that Sir Frederick Bramwell's forebodings that the passing of this Bill means the beginning of the end in carrying out public enterprises with private capital are ill founded we feel convinced. He is right in believing that private enterprise has made England what she is, and we should be sorry to think that this will not be still more developed in the immediate future.

THE CHEMISTRY OF THE PLANTÉ AND FAURE CELL.

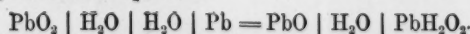
[On pages 21 and 211 of vol. X. of the ELECTRICAL REVIEW we reprinted, from the columns of our esteemed contemporary *Nature*, two interesting and valuable articles bearing on the above subject. These were written by Drs. Gladstone and Tribe, and we now republish a third paper by these two gentlemen, for which we are again indebted to the same journal.]

PART III.—The Discharge of the Cell.

THE two plates of a Planté or Faure battery consist essentially of lead peroxide as the negative element, and metallic lead in a spongy condition as the positive. These are brought into communication with one another through the lead plates which support them, together with the connecting wire.

The lead peroxide reacts both with the lead plate that supports it, and with the lead on the opposite plate. At first sight, it might be expected that the reaction between it and the supporting plate would be the greater, as the space between them is so small, and the resistance of the intervening liquid in consequence almost inappreciable. The action is, indeed, probably greater at the first moment, but, as explained in our first paper, sulphate of lead is immediately produced, and that which lies at or near the points of junction forms no doubt a serious obstacle to further local action and admits of the lead on the opposite plate coming more fully into play.

If we consider *a priori* what is likely to be the reaction between lead peroxide and lead, with water as the connecting fluid, we should expect:—



On experiment this is found to be actually the case, yellow oxide appearing on the negative plate, and white hydrate on the positive.

If, however, the reaction takes place in presence of dilute sulphuric acid, the result will inevitably be sulphate on both sides, for even if oxide be first formed, it will be attacked by that acid. Of course this production of lead sulphate on each side might be expected gradually to produce a perfect electrical equilibrium. This, in fact, does take place under

certain circumstances, but not under others. The reaction on the negative plate is always of this character, as far as our analyses have shown. We have invariably found the deposit to consist of sulphate of lead mixed with unaltered peroxide. If, however, the cell be allowed to discharge itself rapidly the lead on the positive plate is converted, not only into the sulphate, but, very partially, into lead peroxide. This is sometimes evident to the eye from the puce colour of the superficial layer, and we found also that this was confirmed by several chemical tests.

It is difficult to conceive how the reduction of the peroxide of lead on the one plate to oxide or sulphate should be attended by a direct oxidation of lead on the other plate up to peroxide itself, as that would involve a reversal of the electromotive force. It is more easy to imagine that the peroxide results from the oxidation of sulphate of lead already formed, through the agency of electrolytic oxygen.

When this peroxide is formed on the positive plate, it is not difficult to foresee what must happen. A state of electrical equilibrium will be approached before the peroxide of lead on the negative plate is exhausted. But the two sides are in very different positions with regard to local action. On the negative plate, the peroxide being mixed with a great deal of lead sulphate, it will suffer decomposition only very slowly through the agency of the supporting plate, but the lead peroxide on the positive plate, being mixed not only with lead sulphate, but with spongy metallic lead, will be itself speedily reduced to sulphate. Hence, on breaking the circuit, when local action alone can take place, the peroxide formed on the positive plate during the discharges will be destroyed much more easily than the original peroxide on the other plate. The difference of potential between the plates will be restored, and on connection the cell will be again found in an active condition.

Now it has been frequently observed that partially discharged accumulators do give an increased current after repose, that is, after the circuit has been broken and re-established. It remained for us to ascertain whether the chemical change above described coincided in any way with the physical phenomena. For this purpose we prepared plates according to the method of Faure, and examined carefully the changes of electromotive force and strength of current, which took place during their discharge under known resistances, and the chemical changes that took place under the same circumstances.

We found that the initial electromotive force of freshly prepared cells was 2.25, 2.25, 2.21, and 2.31 volts, averaging 2.25, but that after standing for thirty minutes or so, or when allowed to discharge for a few minutes, it was reduced to about 2.0 volts. We take this to represent the normal electromotive force of the arrangement of lead, lead peroxide, and dilute sulphuric acid, and believe that the higher figure obtained at the first moment is due to the hydrogen and oxygen occluded on the respective plates, and which either diffuse out or are speedily destroyed.

We found, however, that in the discharge the electromotive force diminished under certain conditions. Thus, in an experiment in which the external resistance was 1 ohm, and the internal 0.58 ohm, the E.M.F. sank in forty-five minutes from 2.25 to 1.92, but after being disconnected for thirty minutes, it was found to have risen to 1.96, and after eighteen hours' repose it had actually risen to 1.98 volts. These observations were made many times in succession during the course of the experiment which lasted six days.

With twenty times the external resistance, the diminution of electromotive force was much slower; but after discharging three days, the fall was more pronounced, and the rise on repose very apparent.

With 100 ohms resistance the electromotive force varied very little for three days.

It is more difficult to obtain satisfactory chemical evidence of a quantitative character. It is clear that as chemical examination means the destruction of the substances, the same plate cannot be analysed in two consecutive stages. Nor can two plates be easily compared with one another, although they have been formed under the same circumstances. Even the same positive plate, during or after discharge, presents to the eye very different appearance in different parts. To a certain extent we obviated this difficulty by cutting the plate in two, longitudinally,

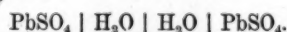
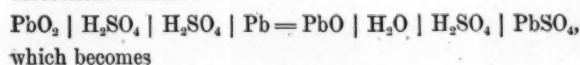
analysing the one half at once, and allowing the other to repose for a given time before examining it for peroxide of lead.

As to the estimation of peroxide in the presence of metallic lead, we finally adopted as the best method that of reducing it by means of oxalic acid, although we were not certain that the whole amount is obtained in this way, even though the solution be kept hot for a considerable time.

By this method many chemical examinations were made of the positive plate. The results are as follows:—First of all, when the external resistance did not exceed 20 ohms the peroxide of lead was generally visible in patches, and its presence was demonstrated and approximately measured by various chemical tests. On repose, the quantity of this peroxide visibly diminished, and in the majority of instances the chemical analyses also showed a smaller amount. In all cases sulphate of lead makes its appearance early in the action, and gradually increases in quantity, becoming finally the only product of the discharge.

The deposit on the negative plate shows the presence of nothing but sulphate of lead in addition to the unchanged peroxide. At the conclusion of the action we have always found more or less of this substance unaltered. Thus, as one instance, after a discharge lasting five days, and approximately complete, we found that only 68 per cent. of the deposit was lead sulphate.

We conclude therefore that the chemical action of the discharge is essentially what is expressed by the following theoretical formula:—



This reaction is, however, sometimes complicated by the formation of a small amount of peroxide of lead on the positive plate. We believe this to be due to the oxidation of sulphate, an action which was explained in our last paper.

Another conclusion has reference to the resuscitation of power observed on repose. This is not due to any purely physical action, but is a necessary consequence of the formation of PbO_2 on the positive plate. As sooner or later the result of the action becomes solely PbSO_4 , this temporary formation of peroxide does not seriously affect the quantity of electrical force that may be regained from the accumulator, but it does affect the evenness of its flow. The flow is more regular if the discharge be made slowly, but in that case the loss on the negative plate from local action will probably be greater.

As to practical conclusions, we may note—1. Although, as stated in our paper of March 9th, the most economical arrangement for the initial charging of the cell is to “make the red lead to be hydrogenated much smaller in amount than that to be oxidated,” yet, as foreshadowed in the same paper, this arrangement is not desirable for the discharge of the cell. Nor is it for its subsequent charging, since, as will have been seen, the substances to be acted upon are now very different. On the negative plate there will be the sulphate of lead produced by the discharge, plus sulphate of lead, produced by local action, together with more or less unaltered peroxide. On the positive plate there will be the sulphate of lead produced by the discharge, together with excess of lead, if any. Unless, therefore, the peroxide of lead unacted upon is allowed to be very considerable, the quantity of lead compound on the two sides ought to approach equality. 2. Care should be taken that sulphuric acid is in sufficient excess to allow of there still remaining some of it in solution after all the available lead has been converted into sulphate. If it is removed and only water is present, an oxide or hydrate will be produced with probably some serious consequences to the cell.

PATENTS FOR SIX MONTHS.—The number of applications for patents during the first six months of the present year amounted to 3,102, exhibiting a marked increase over those of the corresponding period of 1881, when only 2,865 applications were recorded. London furnished 775, the United States 397, France 261, and Germany 250. The electric light occupies a very prominent position amongst the inventions.

HARRISON, COX-WALKER & Co.'s TELEPHONE CALL.

The object of this apparatus (devised and patented by Mr. Anders, formerly electrician to the American Bell Telephone Company) is to enable any one subscriber out of a number looped in on a single circuit, either to be called by the central exchange office, or by any other subscriber.

The whole apparatus is of a very simple nature, and consists of two keys and an indicator at each office or station; this indicator is shown in outward appearance by fig. 1.

One of the two keys sends positive currents, whilst the other sends negative currents; these two keys are of ordinary construction and do not possess any peculiarities.

The indicator at each station is in outward appearance similar to fig. 1, the hand is worked by a step-by-step propellant, worked by an electro-magnet with a polarised armature pulled in one direction by a spring, so that only the intermittent currents sent by one of the two keys will actuate it and work the hand round the dial. As all the indicators are similarly worked, and as they are all looped in on one circuit, it follows that they will all move in unison when intermittent currents are sent by the key referred to.

The general working of the apparatus is as follows:—the index hands of all the instruments being at zero, any station who desires to call, depresses key No. 1 several times (the reason of this will be afterwards explained), he then does the same with key No. 2, so as to send intermittent positive currents, say, out to line, and this he continues to do until he has worked the hand of his indicator round to the number of the subscriber whose attention he desires to call. This being done he next again depresses and raises key No. 1 several times, this has the effect of sounding a bell in the instrument of the subscriber referred to. After the communication is finished, he again sends intermittent currents from key No. 2, so as to work the index hand of his apparatus round to zero; when, however, this has taken place, he still continues to alternately depress and raise his key a few more times, though this operation will not cause those index hands which have arrived at zero to advance further, since they become arrested at the latter point by a stop; those hands, however, that may have accidentally lagged behind will, by the few additional currents, have been brought to zero.

Now the first operation which took place—namely, the depression of key No. 1—had for its object the release of all the index hands from the zero stops against which they had become arrested, so that when key No. 2 was depressed they would be free to move forward. The way in which this releasing is effected, and the means by which it happens that only the bell at the office of the subscriber it is desired to call is rung, will be understood from figs. 2 and 3, the latter being an enlarged general plan of portions of the mechanism.

Referring to fig. 2, *w* is a propellant wheel actuated by an anchor attached to a soft iron tongue. This tongue is polarised from its lower end by one end of a permanent steel magnet, *M*, and plays between the two poles of two electro-magnets, whose other poles are connected by a soft iron strap. The anchor is normally pulled over to the right by a spiral spring (not seen in the figure).

A second soft iron tongue, *t* (see fig. 3), is polarised by the second pole of the permanent magnet, *M*, and this tongue also plays between the poles of two electro-magnets. The four electro-magnets are connected together in one circuit, the connections being so made that when the magnets are excited, one tongue tends to move to the right, whilst the other tends to move to the left. It is evident, therefore, that as one tongue is normally drawn to the left by a spring, and tongue, *t*, is normally pressed to the right by another spring, that currents in one direction only affect the former, whilst currents in the opposite direction only affect *t*.

Referring now to fig. 3, *w* shows the propellant wheel, a portion of which is broken away to show the disc, *f*. This disc is fixed to the same axle as *w*, and turns with it. To the tongue, *t*, which is axled at *h*, is fixed the curved wire, *k*, to

expenses forming such a large proportion of the original outlay would be paid for by the local authority taking over the business, and would be quite fairly charged to them, since they would be forced to spend a like amount if they started *de novo* in their town.

Looking at the matter purely from a commercial point of view, being the one which my managing directorship of an electric light company daily presses upon me, I should say that the Bill with its present purchase clause is not sufficiently tempting to induce capitalists to put money largely into companies contemplated by the Act.

They will feel that the early consumers, though willing if necessary to pay more than the price of gas for the manifest advantages connected with the electric light, could not be fairly asked to bear the dead expenses which should always be considered as part of the capital, and not charged to revenue.

If, on the other hand, the clause is amended so that the local authority which elects to purchase pays for the electrical apparatus upon its value as a going concern, then an immense stride will have been made towards admitting the public to participate in the boon, as the result would be an immediate setting on foot of undertakings to supply the electric current from house to house.

In the meantime we cordially agree with both gentlemen that there is ample work and to spare of an isolated nature for all the electric light companies at present established; but that Sir Frederick Bramwell's forebodings that the passing of this Bill means the beginning of the end in carrying out public enterprises with private capital are ill founded we feel convinced. He is right in believing that private enterprise has made England what she is, and we should be sorry to think that this will not be still more developed in the immediate future.

THE CHEMISTRY OF THE PLANTÉ AND FAURE CELL.

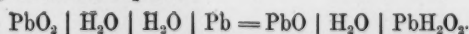
[On pages 21 and 211 of vol. X. of the ELECTRICAL REVIEW we reprinted, from the columns of our esteemed contemporary *Nature*, two interesting and valuable articles bearing on the above subject. These were written by Drs. Gladstone and Tribe, and we now republish a third paper by these two gentlemen, for which we are again indebted to the same journal.]

PART III.—*The Discharge of the Cell.*

THE two plates of a Planté or Faure battery consist essentially of lead peroxide as the negative element, and metallic lead in a spongy condition as the positive. These are brought into communication with one another through the lead plates which support them, together with the connecting wire.

The lead peroxide reacts both with the lead plate that supports it, and with the lead on the opposite plate. At first sight, it might be expected that the reaction between it and the supporting plate would be the greater, as the space between them is so small, and the resistance of the intervening liquid in consequence almost inappreciable. The action is, indeed, probably greater at the first moment, but, as explained in our first paper, sulphate of lead is immediately produced, and that which lies at or near the points of junction forms no doubt a serious obstacle to further local action and admits of the lead on the opposite plate coming more fully into play.

If we consider *à priori* what is likely to be the reaction between lead peroxide and lead, with water as the connecting fluid, we should expect:—



On experiment this is found to be actually the case, yellow oxide appearing on the negative plate, and white hydrate on the positive.

If, however, the reaction takes place in presence of dilute sulphuric acid, the result will inevitably be sulphate on both sides, for even if oxide be first formed, it will be attacked by that acid. Of course this production of lead sulphate on each side might be expected gradually to produce a perfect electrical equilibrium. This, in fact, does take place under

certain circumstances, but not under others. The reaction on the negative plate is always of this character, as far as our analyses have shown. We have invariably found the deposit to consist of sulphate of lead mixed with unaltered peroxide. If, however, the cell be allowed to discharge itself rapidly the lead on the positive plate is converted, not only into the sulphate, but, very partially, into lead peroxide. This is sometimes evident to the eye from the puce colour of the superficial layer, and we found also that this was confirmed by several chemical tests.

It is difficult to conceive how the reduction of the peroxide of lead on the one plate to oxide or sulphate should be attended by a direct oxidation of lead on the other plate up to peroxide itself, as that would involve a reversal of the electromotive force. It is more easy to imagine that the peroxide results from the oxidation of sulphate of lead already formed, through the agency of electrolytic oxygen.

When this peroxide is formed on the positive plate, it is not difficult to foresee what must happen. A state of electrical equilibrium will be approached before the peroxide of lead on the negative plate is exhausted. But the two sides are in very different positions with regard to local action. On the negative plate, the peroxide being mixed with a great deal of lead sulphate, it will suffer decomposition only very slowly through the agency of the supporting plate, but the lead peroxide on the positive plate, being mixed not only with lead sulphate, but with spongy metallic lead, will be itself speedily reduced to sulphate. Hence, on breaking the circuit, when local action alone can take place, the peroxide formed on the positive plate during the discharges will be destroyed much more easily than the original peroxide on the other plate. The difference of potential between the plates will be restored, and on connection the cell will be again found in an active condition.

Now it has been frequently observed that partially discharged accumulators do give an increased current after repose, that is, after the circuit has been broken and re-established. It remained for us to ascertain whether the chemical change above described coincided in any way with the physical phenomena. For this purpose we prepared plates according to the method of Faure, and examined carefully the changes of electromotive force and strength of current, which took place during their discharge under known resistances, and the chemical changes that took place under the same circumstances.

We found that the initial electromotive force of freshly prepared cells was 2.25, 2.25, 2.21, and 2.31 volts, averaging 2.25, but that after standing for thirty minutes or so, or when allowed to discharge for a few minutes, it was reduced to about 2.0 volts. We take this to represent the normal electromotive force of the arrangement of lead, lead peroxide, and dilute sulphuric acid, and believe that the higher figure obtained at the first moment is due to the hydrogen and oxygen occluded on the respective plates, and which either diffuse out or are speedily destroyed.

We found, however, that in the discharge the electromotive force diminished under certain conditions. Thus, in an experiment in which the external resistance was 1 ohm, and the internal 0.58 ohm, the E.M.F. sank in forty-five minutes from 2.25 to 1.92, but after being disconnected for thirty minutes, it was found to have risen to 1.96, and after eighteen hours' repose it had actually risen to 1.98 volts. These observations were made many times in succession during the course of the experiment which lasted six days.

With twenty times the external resistance, the diminution of electromotive force was much slower; but after discharging three days, the fall was more pronounced, and the rise on repose very apparent.

With 100 ohms resistance the electromotive force varied very little for three days.

It is more difficult to obtain satisfactory chemical evidence of a quantitative character. It is clear that as chemical examination means the destruction of the substances, the same plate cannot be analysed in two consecutive stages. Nor can two plates be easily compared with one another, although they have been formed under the same circumstances. Even the same positive plate, during or after discharge, presents to the eye very different appearance in different parts. To a certain extent we obviated this difficulty by cutting the plate in two, longitudinally,

analysing the one half at once, and allowing the other to repose for a given time before examining it for peroxide of lead.

As to the estimation of peroxide in the presence of metallic lead, we finally adopted as the best method that of reducing it by means of oxalic acid, although we were not certain that the whole amount is obtained in this way, even though the solution be kept hot for a considerable time.

By this method many chemical examinations were made of the positive plate. The results are as follows:—First of all, when the external resistance did not exceed 20 ohms the peroxide of lead was generally visible in patches, and its presence was demonstrated and approximately measured by various chemical tests. On repose, the quantity of this peroxide visibly diminished, and in the majority of instances the chemical analyses also showed a smaller amount. In all cases sulphate of lead makes its appearance early in the action, and gradually increases in quantity, becoming finally the only product of the discharge.

The deposit on the negative plate shows the presence of nothing but sulphate of lead in addition to the unchanged peroxide. At the conclusion of the action we have always found more or less of this substance unaltered. Thus, as one instance, after a discharge lasting five days, and approximately complete, we found that only 68 per cent. of the deposit was lead sulphate.

We conclude therefore that the chemical action of the discharge is essentially what is expressed by the following theoretical formula:—

$PbO_2 \mid H_2SO_4 \mid H_2SO_4 \mid Pb = PbO \mid H_2O \mid H_2SO_4 \mid PbSO_4$,
which becomes

$PbSO_4 \mid H_2O \mid H_2O \mid PbSO_4$.

This reaction is, however, sometimes complicated by the formation of a small amount of peroxide of lead on the positive plate. We believe this to be due to the oxidation of sulphate, an action which was explained in our last paper.

Another conclusion has reference to the resuscitation of power observed on repose. This is not due to any purely physical action, but is a necessary consequence of the formation of PbO_2 on the positive plate. As sooner or later the result of the action becomes solely $PbSO_4$, this temporary formation of peroxide does not seriously affect the quantity of electrical force that may be regained from the accumulator, but it does affect the evenness of its flow. The flow is more regular if the discharge be made slowly, but in that case the loss on the negative plate from local action will probably be greater.

As to practical conclusions, we may note—1. Although, as stated in our paper of March 9th, the most economical arrangement for the initial charging of the cell is to “make the red lead to be hydrogenated much smaller in amount than that to be oxidated,” yet, as foreshadowed in the same paper, this arrangement is not desirable for the discharge of the cell. Nor is it for its subsequent charging, since, as will have been seen, the substances to be acted upon are now very different. On the negative plate there will be the sulphate of lead produced by the discharge, plus sulphate of lead, produced by local action, together with more or less unaltered peroxide. On the positive plate there will be the sulphate of lead produced by the discharge, together with excess of lead, if any. Unless, therefore, the peroxide of lead unacted upon is allowed to be very considerable, the quantity of lead compound on the two sides ought to approach equality. 2. Care should be taken that sulphuric acid is in sufficient excess to allow of there still remaining some of it in solution after all the available lead has been converted into sulphate. If it is removed and only water is present, an oxide or hydrate will be produced with probably some serious consequences to the cell.

PATENTS FOR SIX MONTHS.—The number of applications for patents during the first six months of the present year amounted to 3,102, exhibiting a marked increase over those of the corresponding period of 1881, when only 2,865 applications were recorded. London furnished 775, the United States 397, France 261, and Germany 250. The electric light occupies a very prominent position amongst the inventions.

HARRISON, COX-WALKER & Co.'s TELEPHONE CALL.

THE object of this apparatus (devised and patented by Mr. Anders, formerly electrician to the American Bell Telephone Company) is to enable any one subscriber out of a number looped in on a single circuit, either to be called by the central exchange office, or by any other subscriber.

The whole apparatus is of a very simple nature, and consists of two keys and an indicator at each office or station; this indicator is shown in outward appearance by fig. 1.

One of the two keys sends positive currents, whilst the other sends negative currents; these two keys are of ordinary construction and do not possess any peculiarities.

The indicator at each station is in outward appearance similar to fig. 1, the hand is worked by a step-by-step propellant, worked by an electro-magnet with a polarised armature pulled in one direction by a spring, so that only the intermittent currents sent by one of the two keys will actuate it and work the hand round the dial. As all the indicators are similarly worked, and as they are all looped in on one circuit, it follows that they will all move in unison when intermittent currents are sent by the key referred to.

The general working of the apparatus is as follows:—the index hands of all the instruments being at zero, any station who desires to call, depresses key No. 1 several times (the reason of this will be afterwards explained), he then does the same with key No. 2, so as to send intermittent positive currents, say, out to line, and this he continues to do until he has worked the hand of his indicator round to the number of the subscriber whose attention he desires to call. This being done he next again depresses and raises key No. 1 several times, this has the effect of sounding a bell in the instrument of the subscriber referred to. After the communication is finished, he again sends intermittent currents from key No. 2, so as to work the index hand of his apparatus round to zero; when, however, this has taken place, he still continues to alternately depress and raise his key a few more times, though this operation will not cause those index hands which have arrived at zero to advance further, since they become arrested at the latter point by a stop; those hands, however, that may have accidentally lagged behind will, by the few additional currents, have been brought to zero.

Now the first operation which took place—namely, the depression of key No. 1—had for its object the release of all the index hands from the zero stops against which they had become arrested, so that when key No. 2 was depressed they would be free to move forward. The way in which this releasing is effected, and the means by which it happens that only the bell at the office of the subscriber it is desired to call is rung, will be understood from figs. 2 and 3, the latter being an enlarged general plan of portions of the mechanism.

Referring to fig. 2, *w* is a propellant wheel actuated by an anchor attached to a soft iron tongue. This tongue is polarised from its lower end by one end of a permanent steel magnet, *m*, and plays between the two poles of two electro-magnets, whose other poles are connected by a soft iron strap. The anchor is normally pulled over to the right by a spiral spring (not seen in the figure).

A second soft iron tongue, *t* (see fig. 3), is polarised by the second pole of the permanent magnet, *m*, and this tongue also plays between the poles of two electro-magnets. The four electro-magnets are connected together in one circuit, the connections being so made that when the magnets are excited, one tongue tends to move to the right, whilst the other tends to move to the left. It is evident, therefore, that as one tongue is normally drawn to the left by a spring, and tongue, *t*, is normally pressed to the right by another spring, that currents in one direction only affect the former, whilst currents in the opposite direction only affect *t*.

Referring now to fig. 3, *w* shows the propellant wheel, a portion of which is broken away to show the disc, *f*. This disc is fixed to the same axle as *w*, and turns with it. To the tongue, *t*, which is axled at *h*, is fixed the curved wire, *k*, to

the extreme end of which is attached the bell hammer (see fig. 2). Attached to *k* is a small projecting piece, *d*. This projecting piece being in a line with the disc, *f*, presses against the circumference of the latter when *k* is moved to the right by the attraction of the tongue, *t*, thus the hammer at the end of *k* is prevented from striking the bell. When, however, the disc has, by the movement of the wheel, *w*, become turned round so that the notch, *g*, comes opposite (or nearly opposite) *d*, then *k* can have its full movement and its hammer can strike the bell.

On the axle on which *w* and *f* are fixed is secured an arm, *c*. This arm has near its end and on its inner face a small wedge-shaped projection, *b*. The piece, *d*, has a similar projection, *a*, on its outer face. Now supposing *k*

These latter currents, as explained at the beginning of the article, are sent at the commencement of the calling operations.

Now by so setting the position of the notch, *g* (on the disc, *f*), in the various instruments that the notch in, say No. 7 instrument, comes opposite the piece, *d*, when the indicating hand of No. 7 points to that number, then it is evident that the bell of No. 7 only can be sounded when the index hands of all the instruments point to 7; and similarly if all the hands point to 5, then the bell of No. 5 only can be sounded.

As the wheel, *w*, has forty teeth cut on it—that is to say, as five movements of the anchor will be required to move the index hands from one number to the next, and as the

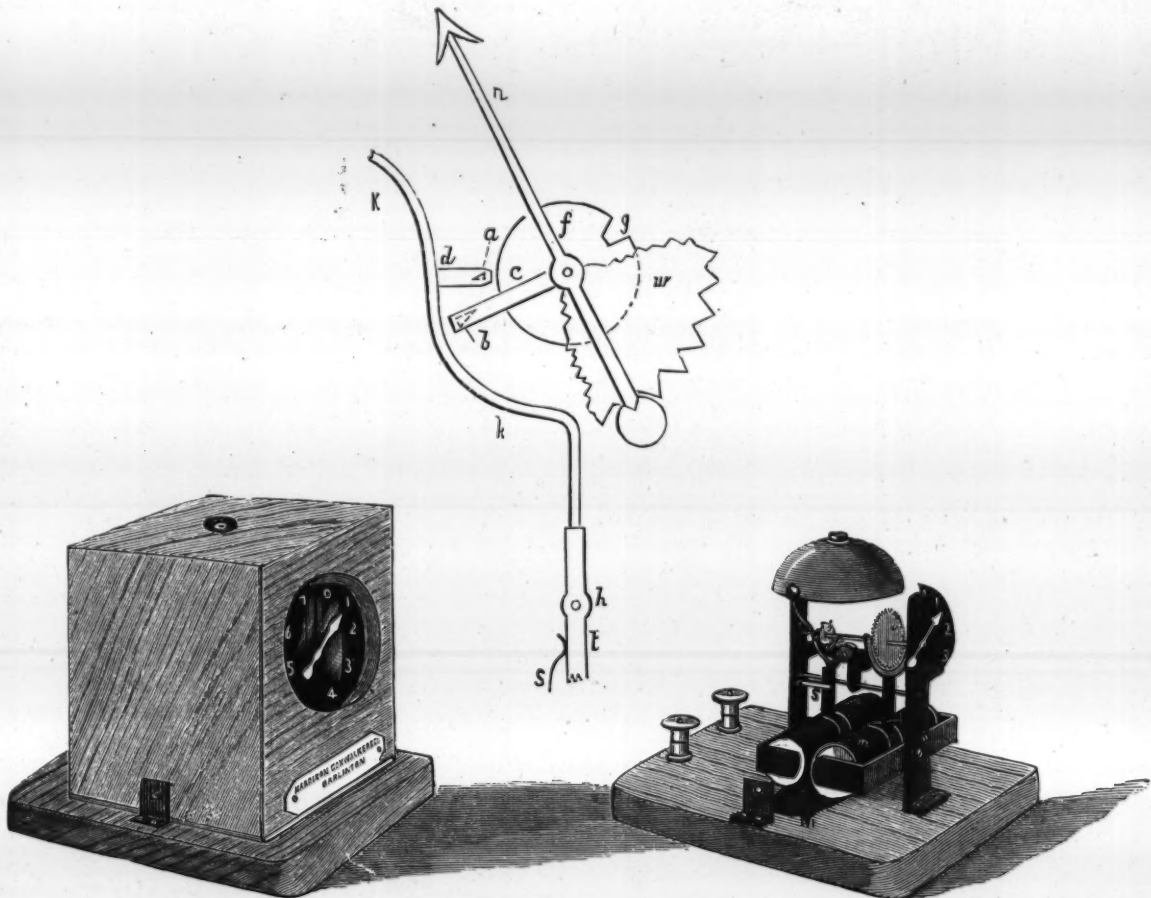


FIG. 1.

FIG. 3.

FIG. 2.

to be in its normal position, then, if the arm, *c*, becomes moved round, the projection, *b*, will come in contact with the projection, *a*, and the movement of *c*, and consequently also of the hand, *n*, will become arrested; in this position *n* points to zero on the dial.

Now the position of the arm, *c*, is so arranged with reference to the wheel, *w*, that when *b* has been worked round so as to be just in contact with *d*, then the propellant anchor is just on the point of moving *w* under the influence of the retractile spring. Under these conditions it follows that if *k* be moved slightly to the right by the action of the electro-magnet acting on *t*, so as to free *a* from *b*, then the wheel, *w*, will move slightly forward by the propellant anchor being pulled quite home into the teeth of *w* by the spring. When, therefore, *k* drops back to its normal position, the projection, *a*, will come underneath the projection, *b*, and the movement of *c* will no longer be prevented. Thus the wheel, *w*, and the pointer, *n*, are free to move. We thus see that when a series of intermittent currents in one direction are sent by key No. 2, the wheel, *w*, and the indicator hand, *n*, can be worked round to zero, but no further, and that in order that the rotation may be continued it is necessary to move *k*, which is done by a current, or currents, sent by key No. 2.

notch, *g*, is made sufficiently broad—an accidental skip of one or two movements of the anchor in the course of the revolution of the wheel, *w*, will not prevent the bell ringing at the proper station. Such accidental skipping as has been pointed out will be corrected at the final stage of the calling operation by bringing all the hands up to the zero stops.

HASKINS' ARC ELECTRIC LAMP.

THIS is the invention to which we alluded in a short note last week under the name of the "Diamond" arc lamp. We now purpose entering more fully into its construction and design, for although any person can devise an arc lamp differing in some points from preceding specifications, and notwithstanding that the number of such lamps is legion, there are decidedly merits in the invention under discussion which deserve more than a passing notice. Mr. Haskins is well known in America, and here also, as a leading electrician, and on this account alone one would naturally expect something out of the ordinary from his inventive faculties. The lamp in question, as we have before stated, is to be seen in

action at 374, Euston Road; the current necessary for producing the light being supplied by a Weston dynamo-electric machine. Before entering into a description of the Diamond arc lamp we will briefly call the attention of our readers to a somewhat similar idea of Mr. Haskins, which we extract with an illustration (see fig. 1) from the *Official Gazette* of the United States Patent Office. The number of this patent is 261,091, and was filed in the

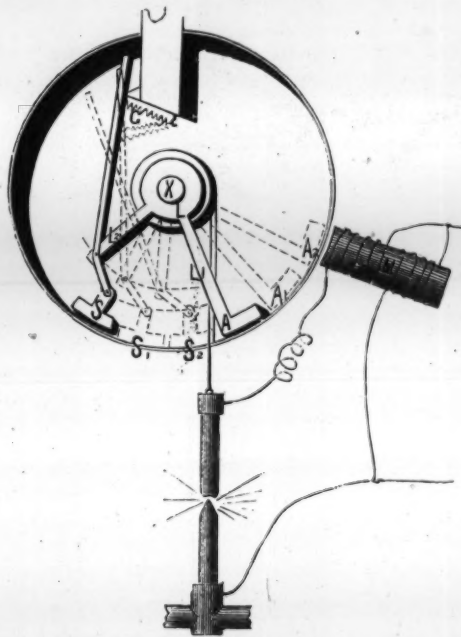


FIG. 1.

United States of America Patent Office January 25th, 1882. The claim of Mr. Haskins which follows will sufficiently explain the sketch:—

“The combination, substantially as hereinbefore set forth, of the movable electrode of an arc lamp, an electro-magnet vitalised by the light-producing current, and an intermediate

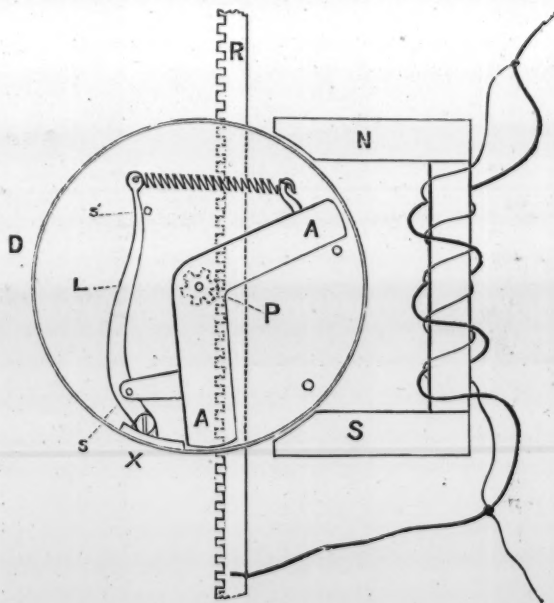


FIG. 2.

regulating mechanism consisting of a drum mechanically connected with said electrode, and an armature and a clamping-lever connected together and pendulously suspended from the axis of said drum, said clamping-lever being adapted to act against the inner periphery of said drum.”

It is evidently intended that the fine wire of the electro-magnet shall, when the current passes through, partially demagnetise the core; or rather weaken the magnetism produced in the core by the main current flowing through the thick coil.

Most of the arc lamps at present in operation have the lower carbon fixed, and the upper one is allowed to approach the lower when necessary by its weight alone. The object of the electro-magnetic devices of various forms employed in such lamps is usually for the purpose of parting the carbons, thus forming the arc, regulating the length of the arc, and also for releasing the grip or clutch holding up the top carbon, so that it may descend towards the lower when the length of arc increases beyond its normal state. In the same manner the Haskins lamp depends upon gravity for the descent of the upper carbon, and an electro-magnetic apparatus, or feeding mechanism, applied to the upper carbon regulates its action. In the following sketch of the working parts of this invention, fig. 2, it will be seen that the upper carbon holder is shown—as in many other lamps—as a light toothed bar or rack, R. This gears into a pinion, P, fastened to the centre of a flanged disc, D, which is accordingly rotated by the lifting up or falling of the rack. To control the downward movement of the carbon holder it is only necessary to apply a brake to the inside rim or flange of this disc, and as this latter may be of any required size, the power requisite to check its motion and resist the weight of the carbon holder may be very small, and the magnetic attraction necessary for this purpose may, therefore, be comparatively slight. The brake is shown in the figure at X, and forms the foot of a bent lever, L, pivoted at S on one arm of the armature, A, A. This armature is pivoted at the centre of the disc, D, about which it swings freely in response to the varying magnetic attraction of the poles, N, S, of the electro-magnet. It is claimed that on account of the manner in which the armature is hung between the poles of the electro-magnet a very slight attraction serves to deflect it, and as the leverage with which the attractive force acts upon the armature decreases as it approaches the poles, the magnetic pull is uniform throughout the entire movement, instead of being subject to a violent variation, as is the case when an armature approaches the poles in the line of the magnetic attraction.

The core of the electro-magnet is wound with two coils, one of thick and the other of thin wire. In the lamps as actually used, the thin wire is wound first upon the core, and the thick coil outside this. The main circuit includes the carbons and the thick wire, the fine coil being in a derived circuit or shunt to the arc. When the lamp is ready for action and the carbons touching, all the current except the little passing through the fine wire coil, goes through the main path, and the electro-magnet is, therefore, strongly magnetised. The armature at both ends is attracted and carries with it the brake, X, which clamps against the inside rim of the disc, D. Any further motion of the armature must then necessarily turn the disc, which raises the upper carbon, thus establishing the arc. Suppose that only the thick wire coil is wound upon the electro-magnet, then as the current weakens through the lengthening of the arc, as the carbons consume, the ends of the armature not being so strongly attracted swing away from the poles of the electro-magnet, and in so doing the carbon is lowered to a slight extent. When it reaches the position in which the upper end of the lever, L, bears against the pin, S', the brake, X, is released, and the carbon is free to slide downwards. Since the magnetic attraction is applied in a way to render the device equally sensitive to currents of different strengths, and since, on account of the leverage obtained by the disc, a comparatively feeble current can overcome the weight of the carbon, a small arc can be as readily formed as a large one. The lamp automatically adjusts itself to the current sent through it, and the brake needs no adjustment, as the armature simply moves through a less or greater distance, forming a short or long arc, as the current increases or decreases in strength. The use of the fine wire coil is explained as follows:—With only the thick wire on the electro-magnet, the light remains constant only as long as the current itself is so. Considerable fluctuations in this current, such as occur when a number of lamps are in circuit, will therefore cause an unsteadiness of the light, unless some arrangement is provided for equalising the variations. This is the duty of

the fine wire coil, which provides a path for the current around the arc, and as the direction of the current through it is in a contrary direction to that passing by the thick wire, it constantly tends to weaken this. When the current greatly increases, the shunt coil takes its share of the increase, thus tending to diminish the excess of current in the thick coil. This appears an odd way of explaining the use of the fine wire circuit, which is simply to partially neutralise the

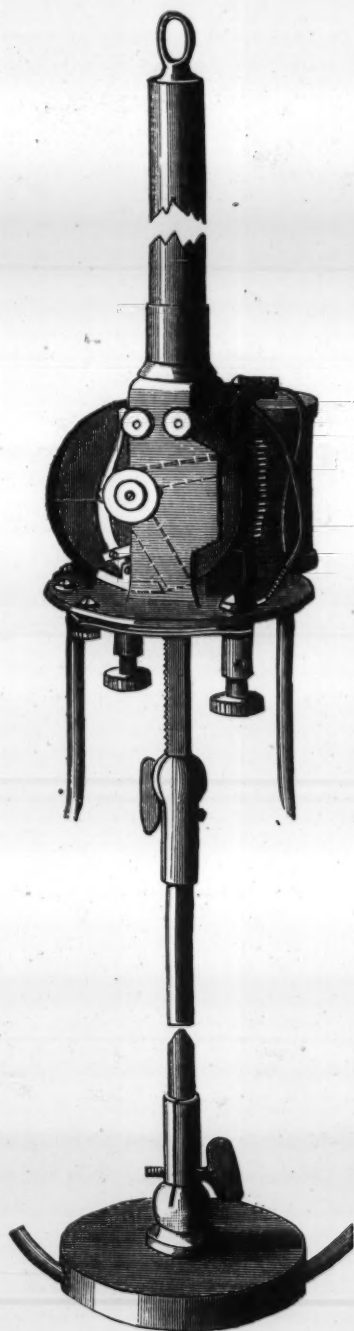


FIG. 3.

magnetism developed in the core of the electro-magnet by the current which passes through the thick coil. Of course, if an abnormal resistance should occur in the main circuit of the lamp, the carbons would quickly drop together, and start afresh.

The general view of the mechanism of this lamp is shown in fig. 3.

We are indebted for portions of our description to the pamphlet of the Union Electric Manufacturing Company of

New York, and for the last sketch to the courtesy of Mr. Newson, of Isleworth, the agent for the sale of the patent rights of this lamp in Great Britain and Europe, who kindly sent to our office a lamp from which the drawing was made. It would be hard to find a lamp on the arc system, with one carbon above another, to equal this. There is apparently nothing whatever of a delicate nature in its whole construction, and therefore the liability to derangement is reduced to a minimum. The disc, with the friction brake, is a capital arrangement, and it will be seen that *both* poles of the electro-magnet are usefully employed. The use of a shunt circuit for demagnetising or reducing the magnetism produced by the main coil, although not new, is well adapted to its purpose in the Haskins lamp. The nearest approach to this invention which we can call to mind at the moment is the arc lamp of Mr. Andrew Common, who employed a disc and brake, and also a rack and pinion, and a shunt circuit, in opposition to his main coil. The two lamps, however, are in some other points dissimilar, especially in regard to the electro-magnetic apparatus, as in the last-mentioned lamp a solenoid was made use of. The proprietors of the Haskins lamp may rest assured that as far as merit is concerned it should take a leading position, not merely electrically, but commercially; and we can safely say that as far as compactness, simplicity, excellence of design, both electrical and mechanical, and lastly—for such a type of lamp—its extreme lightness, it can certainly hold its own. Having twice seen the lamp, we feel convinced of its superiority in several important points over most of those at present in actual operation.

Since writing our description of Mr. Haskins' lamp, we have received a copy of the following report on its merits. Mr. Farquhar is well known as an expert in electric lighting matters, and his opinion is therefore worthy of consideration:—

DEAR SIR,—In regard to the Diamond Arc Lamp, of which I have made a thorough test and investigation, I may state in a few words its superiority over other arc lamps.

1. The great simplicity of the mechanism used to keep the carbon points at an uniform distance; this same mechanism acting at the same time as the arc starter.

2. The comparatively light weight of the lamp which, complete, does not exceed 10 lbs. I do not know of any other lamp of equal lighting capacity as the one in question, which weighs so little.

3. As regards economy of manufacture, I should state confidently that the Diamond lamp, if manufactured on a large scale, would create quite a revolution in arc lighting, as the small cost of the lamp would overcome one of the great obstacles at present to economic electric lighting.

4. One great and important feature in the Diamond lamp is the relation of the parts and the law of their movements, the effect of which, without entering into details, is such that the lamp automatically adjusts itself to the current sent through it, that is to say, that the arc automatically lengthens if the intensity increases; the lamp therefore acts as a regulator, and affords always a proportional external resistance to the electromotive force of the machine supplying the current; this in a great many instances of practical electric lighting would save serious injury to the dynamo machines.

In conclusion, I may say that after six years of busy employment in practical electric lighting, I have never seen a lamp that recommends itself more to the purpose for which it is intended than the Diamond Arc Lamp.

Yours truly,

— HEARINGTON, Esq.,
374, Euston Road.
17th July, 1882,

CHAS. W. FARQUHAR.

FRENCH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.
—The eleventh session will be held at La Rochelle from the 24th to the 31st of August, 1882. The programme of the session comprises a general inaugural meeting, section sittings, scientific or industrial visits, public conferences, and excursions. Several questions relating to electricity will be treated; amongst others we may mention a paper by M. Marcel Brillouin on the method of comparing co-efficients of induction; the causes of errors and the means of avoiding them; a communication from M. Debrun, Professor at the Lycée of Paris, on a capillary registering electrometer, and the general distribution of electricity. M. Tissandier will expound his researches on small batteries, and M. Hospitalier will hold a conference on the electric light. We shall endeavour to keep our readers well informed concerning the electrical subjects presented to the association.

CORRESPONDENCE.

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer, not necessarily for publication, but as a guarantee of good faith. Correspondence should arrive not later than Tuesday morning if it is desired to appear in the following number.

THE TELEPHONE.

To the Editors of THE ELECTRICAL REVIEW.

SIRS,—In your issue of the 15th of July, Mr. Henry C. Buck thinks fit to criticise the criticism of M. Le Comte du Moncel, and claims that Professor E. Dolbear was the first to apply the vibrations of a condenser to the construction of a telephonic receiver; but he must have forgotten that Mr. Varley, some years before the invention of the Dolbear telephone, constructed an apparatus in which a Reiss transmitter and a battery were inserted in the circuit with the primary wire of an induction coil, to the secondary of which was attached a condenser, which was found to reproduce sound nearly as well as the Reiss receiver. Thus it would appear that the only improvement made by Professor Dolbear was the substitution of flexible plates for the packed condensers, and the use of a transmitter producing undulatory currents instead of intermittent ones.

Yours faithfully,

F. D. WOLFFERS, F.I.S.

56, Portland Place, Clapham, S.W.

July 19th, 1882.

CARBONISING PROCESSES.

To the Editors of THE ELECTRICAL REVIEW.

DEAR SIRS,—Can you, through the columns of your valuable journal or by letter, give me any information in regard to the Bertholetti process of carbonising? Can you give me the name of any work referring to the subject of carbonising?

Very truly yours,

FRED. L. HARRIS.

20, Nelson Square, S.E., July 25th, 1882.

[We will endeavour to find the information our correspondent seeks, and in the meantime perhaps some of our readers may be able to supply his wants.—EDS. ELEC. REV.]

THE CRYSTAL PALACE ELECTRICAL EXHIBITION.

To the Editors of THE ELECTRICAL REVIEW.

SIRS,—Having read "Disque's" letter and your paragraph in your last issue, I should be glad if you would find room for my experiences.

Having had cause to make complaints (as who had not), I adopted the usual course of writing to the management. This being without avail I requested that a deputation from a certain section of exhibitors should be received by the directors. After some delay a reply was forwarded, stating that the chairman and manager would be pleased to hear us. The usual soft soaping took place, and things became worse than before.

I then wrote to the Lord Mayor, whose name heads the list of the Honorary Council of advice. In due course I received a reply from his secretary to the effect that the Lord Mayor knew nothing of the matter, and had forwarded my letter to the Crystal Palace authorities. Of course, I heard nothing further, and concluded the game was not worth the candle.

All exhibitors should now combine and insist upon the directors making the awards known at once, failing which they should decline to enter for the forthcoming exhibition. The Honorary Council of Advice is much too honorary to be troubled with the matter.

Yours truly,

F. W. POPE-COX.

Salisbury Hotel, London, July 26th, 1882.

We have received from Prof. Silvanus Thompson an important letter on the subject of the telephone, but unfortunately too late for insertion in the present number.—EDS. ELEC. REV.

NOTES.

KENNEDY'S ELECTRIC-LAMP PATENTS.—With reference to a statement which appeared at page 386 in the "Notes" of our issue dated 27th May last, we are now able to state on authority, that all oppositions to the patents applied for by Mr. Kennedy, No. 5524 of 1881, No. 1199 of 1882, the latter being the "Solenoid Arc Lamp Patent," have been withdrawn. With reference to the latter, it is important to state that the opposition to it was withdrawn after a declaration had been filed by Sir William Thomson, pointing out the important differences in Kennedy's Arc Lamp over any lamp which had preceded it. The only reason we had for stating what we did was the fact that nothing was mentioned concerning this matter in the Company's prospectus. We are glad to note that these oppositions have not led to any difficulties or complications whatever, that both patents are now completed, and the necessary arrangements carried out under them with the Railway and Electric Appliances Company (Limited).

SCIENTIFIC REPORTS ON ELECTRIC LIGHTING.—We drew attention last week to the extract of Mr. J. E. H. Gordon's report on the "Rogers" incandescent electric lamp, which was published in the daily press during the last day or two remaining, for applications for shares in the J. B. Rogers Electric Light Company. We notice the following letter in the money article of the *Times* of Saturday last:—

"28, Collingham Place, Cromwell Road, S.W., July 21.

"Sir,—I observe in the *Times* of yesterday an advertisement of the J. B. Rogers Electric Light Company, in which it is stated that the full report can be seen at the office.

"On sending to the office I find that this is not the case, as only that portion of my report which alludes to the lamps is shown.

"I shall be obliged if you will permit me to state through the *Times* that my report embraced both the incandescent lamps constructed by Mr. Rogers and the 'system of subdivision' patented by him, and that I stated that the so-called system is worthless. About the rest of the nine patents advertised I have expressed no opinion, as they have not been submitted to me.

"Your obedient servant,

"J. E. H. GORDON."

We cordially endorse Mr. Gordon's opinion on the worthlessness of the system of subdivision, and we can only regret that publicity was not given to this matter before the closing of the share list. That, however, is not Mr. Gordon's fault, for the J. B. Rogers Company apparently took care that his disclaimer should not meet the public gaze until it was useless, for the reason above stated. The same letter was also published, we believe, in the *Standard*, and has called forth the following reply, which appeared in that newspaper on Wednesday:—

SIR,—The attention of the directors of this company has been called to a letter in the Money Article of yesterday's issue of your paper, signed J. E. H. Gordon, in which he states erroneously that a certain report made by him on some of Mr. Rogers' patents was omitted from the report produced at the company's offices to his representative. We are directed to inform you that our clients have never had but one report of Mr. Gordon's, i.e., that on Mr. Rogers' Incandescent Lamp, and that has been produced in its entirety to every applicant who has applied to inspect the documents set out or referred to in the prospectus of this company. The directors have made inquiries of Mr. Rogers and the promoters whether or not any other report of Mr. Gordon's has been made on Mr. Rogers' patents, and they find that Mr. Gordon's draft report did contain an opinion on the "System of Distribution" that Mr. Rogers was mistaken in his views on the subject, but that portion of the report was struck out by Mr. Gordon, and omitted in the fair copy report signed by him and received by the directors.

We refrain from further observations pending the result of counsel's opinion as to the course the directors should adopt in consequence of the publication of Mr. Gordon's letter.

We are, Sir, your obedient servants,
WEST, KING, ADAMS, and CO.

Cannon Street, London, E.C., July 25th.

THE ELECTRIC LIGHT IN EGYPT.—Lieutenant Dickin, of the *Alexandra*, has succeeded in establishing the electric light at Fort Comeldikh.

THE ELECTRIC "SUN" LAMP AND POWER COMPANY.—It is announced that the letters of allotment for the shares of the Electric "Sun" Lamp and Power Company (Limited) were posted on Wednesday evening.

THE ISLAY CABLE.—We understand that the ss. *Morna*, now off Silvertown, will start this morning to repair the above cable.

THE ELECTRIC LIGHT IN THEATRES.—We extract from Thursday's *Standard* the following note from the Paris correspondent of that paper:—"The disastrous fires in theatres, which have lately entailed the loss of so many lives, have induced the Prefect of Police to study the question of lighting places of public amusement, with the view of, if possible, lessening the danger entailed by the use of gas. Till now no very satisfactory result had been achieved. Many experiments with various electric lamps had been made, but all had required the presence in the building of an engine to supply the lamps with electricity. Last night a step was, however, made in the right direction. The Variétés Theatre was lighted up by the English Faure Electric Accumulator Company; the whole house, the stage, footlights, corridors, and green rooms were all lighted with the Swan incandescent lamp. The intensity of the light was very successfully regulated, and the footlights turned on and off with great rapidity. The heat was also very much less than that occasioned by the use of gas. The spectators at these private experiments, among whom were M. Camescasse, almost every theatrical director in Paris, theatrical critics, and many Deputies and Senators, pronounced most favourably on them."

ANOTHER "BRUSH" COMPANY.—We have received the prospectus of the "Brush" Electric Light Company of Ireland (Limited), which has been formed to supply in Ireland electricity for public and private lighting, as a motive power and for other purposes. It has secured concessions from the Anglo-American Brush Corporation for the use of the rights and patents of the latter. The capital is £250,000, of which £130,000 are to be issued now, in 26,000 shares of £5 each. Two thousand shares will be issued as fully paid to the vendors, who will also receive £22,500 in cash. It appears from the prospectus that the company is to take over the business and plant of the Dublin Electric Light Company (Limited) and 6,370 shares are reserved for that purpose. The company is expected to profit largely by "granting sub-licences to local companies." This mode of operating has, no doubt, worked very well, so far, for the original "Brush" Corporation, but is not, as it appears to us, capable of unlimited development, and unless some more solid and lasting earning capacity than this is possessed by the companies which have made it their chief reliance, their profits will cease shortly. It is, perhaps, too much as yet to expect them to show any very large volume of regular business, but in nearly all the prospectuses of this class of companies which have come before us the principal inducement offered to investors is the possibility of selling a concession to some third party, a legitimate operation enough, but one which *ex vi termini* cannot constitute a permanent source of revenue.—*The Times*.

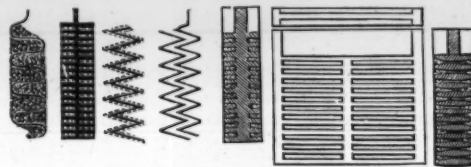
THE HOLBORN GUARDIANS AND THE ELECTRIC LIGHT.—In consequence of the great increase in the gas bill for the infirmary during the last year, notwithstanding that there was a reduction in the price, the board, a short time since, invited tenders for lighting the establishment with the electric light, and the tenders received were as follows: Messrs. Siemens Brothers, £5,000; the Brush Electric Lighting Company, £4,345, and Messrs. Pilsen, Joel and Company, £3,143. The Infirmary Committee reported that the matter was referred to Messrs. Snell and Sons, architects to the board, to report thereon. The committee stated that they had awarded the best thanks of the committee to Messrs. Snell and Sons for their careful and elaborate report, and the committee report to the board that in their opinion it is not advisable to use the electric light at the establishment. Mr. Ross moved the adoption of the report. It was shown that the expense of the electric light was such that they could not think of adopting it at present. Mr. Whiting thought that the subject had not received proper attention, and that another committee might bring up a more favourable report. The present gas-fittings could be adapted to the electric light, and they would get rid of the vitiated atmosphere. The report was then approved. This matter formed the subject of Mr. Snell's correspondence with several of our contemporaries.

SECONDARY BATTERY.—Patent No. 260,654. Filed in the United States of America Patent Office, June 15th 1882, by Charles F. Brush:—



Claim.—The method of forming the plates of a secondary battery consisting in forming receptacles for oxide of lead in its surface, then applying oxide of lead to the plate and within such receptacles, and afterward subjecting the oxide of lead to pressure.

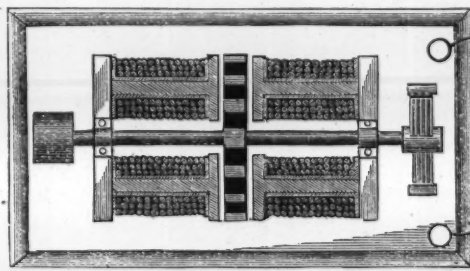
SECONDARY BATTERY.—Patent No. 260,653. Filed in the United States of America Patent Office, June 15th, 1882, by Charles F. Brush:—



Claim.—In a secondary battery, an element consisting of a structure of etagère-like form, containing in the spaces between its shelves lead in a finely-divided state, substantially as set forth.

DYNAMO-ELECTRIC MACHINE.—Patent No. 260,652. Filed in the United States of America Patent Office, June 1st, 1880, by Chas. F. Brush.

Brief.—Surrounds the cores of the field-magnets with a continuous band of sheet copper or other suitable conductor. Over these bands are coiled the magnetising helices in the customary manner, the purpose being to avoid extra currents.



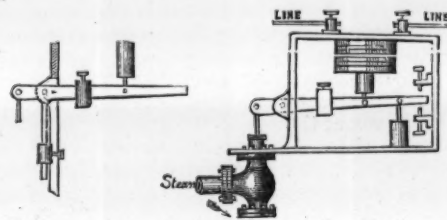
Claim.—1. In a dynamo-electric machine the combination, with the moving coils or bobbins of conductors, of field-of-force magnets having their cores encircled by one or more closed conductors, substantially as set forth.

2. In a dynamo-electric machine the combination of the moving coils or bobbins of conductor within which the electric current is induced, and one or more field-of-force electro-magnets that are surrounded by one or more closed diamagnetic conductors, substantially as and for the purposes set forth.

3. In a dynamo-electric machine, the combination, with the moving coils or bobbins of conductor within which the electric current is induced, of one or more field-of-force electro-magnets that are surrounded by one or more closed diamagnetic conductors, and an exciting helix or helices, also surrounding said field-magnets, substantially as set forth, whereby the insulation of the apparatus is preserved during fluctuations in the current exciting said field-magnets.

INCANDESCENT ELECTRIC LAMPS WITH CARBON FILAMENTS.—We have heard on very good authority that the Edison Electric Light Company has resolved to apply for an injunction against the Swan Electric Light Company, on the ground that the Swan lamp is an infringement of the Edison patents. The case is to be decided before Mr. Justice Chitty, we believe, and indeed, unless other arrangements have been arrived at in the meantime, the case may have been heard before this meets the eyes of our readers. Should the intention of the first-named company be carried out, it will be interesting to see whether the result will be of a like character to the recent telephone trial.

CURRENT GOVERNOR FOR DYNAMO-ELECTRIC MACHINES.
—Patent No. 260,650. Filed in the United States of America Patent Office, June 29th, 1880, by Charles F. Brush.



Brief.—An axial magnet in the main circuit controls a lever connected with the valve, which admits steam to the engine which drives the generator.

Claim.—1. In a system for generating and applying an electric current, the combination of the following-named instrumentalities, to wit: A dynamo-electric machine, a motor for driving said dynamo-electric machine, an external or working circuit upon which is placed one or more electric lamps, electro-motors, or any device to be operated upon or actuated by the electric current, and a governor consisting of a hollow or axial magnet that is energised by current from said dynamo-electric machine, and that is associated with suitable valve or cut-off mechanism, said governor constructed and adjusted to control the speed at which the dynamo-electric machine is driven, according to the varying condition of the current in said external or working circuit, substantially as shown.

5. In combination with an electric governor for regulating the speed at which a dynamo-electric machine is driven, the pendant weight substantially as and for the purpose shown.

ELECTRIC LIGHT AT BEACONSFIELD HOTEL, ADDISON ROAD STATION.—We understand that Mr. W. Cooke, the proprietor, intrusted the installation of the electric light in the above hotel to Messrs. Charles Powis & Co., of Millwall Pier and 60, Gracechurch Street, engineers and electric light contractors. The entrance lobby, bar, and billiard room (containing two full sized tables) are brilliantly lighted with eighty Swan incandescent lamps, and the exterior with a Siemens arc lamp. A Siemens alternating current dynamo-electric machine, driven by an eight horse-power (nominal) gas engine, is fixed in the basement. This installation, which is said to be a permanent one, was officially started on the evening of Saturday, the 15th inst. (the opening day), in a most satisfactory manner, and was witnessed by a large number of Mr. Cooke's friends and customers, who were present during the whole of the evening and expressed themselves highly satisfied at the steadiness and brilliancy of the light.

CHESTERFIELD AND THE ELECTRIC LIGHT.—At a meeting of the Chesterfield Town Council last week a letter was read from the Hammond Electric Light and Power Supply Company asking, in view of the passing of the Electric Light Bill now before Parliament, for the consent of the corporation to run wires under the streets of the borough for the purpose of private lighting. The Mayor pointed out that the request was one of very great importance, for compliance with it would give the company a monopoly of public and private lighting by electricity in the borough. After some discussion it was agreed to refer the application to the Watch Committee.

THE INSURANCE AND THE ELECTRIC LIGHT.—It is reported from America that the fire insurance companies of Philadelphia have decided to cancel policies wherever they find electric conducting wires attached to the roofs of buildings on which they have outstanding risks.

THE ELECTRIC LIGHT AT SYDNEY (N.S.W.)—At a recent meeting of the City Council of Sydney a proposal was received from a London gentleman interested in the formation of syndicates, offering to light the streets and public buildings of Sydney by electricity at a cost of 25 per cent. less than the contract price of the gas now supplied.

THE AUSTRIAN REGULATIONS FOR THEATRES.—From the new Austrian Regulations for Theatres we extract the following:—Electric light: When a theatre is lighted by electricity the installation must be arranged so that the

illumination of the auditorium is wholly independent of that of the stage. In all the parts of the theatre the installation must provide two separate systems and independent circuits, each with its lighting machines and apparatus. The wires must be sufficiently stout to prevent their being overheated; they must be carried along a groove in the wall, and secured against being injured, as well as against the possibility of the audience coming in contact with them. The electric light must be provided with glass globes, and so fixed that it is impossible for particles of the carbon points to fall out. Motors driving the machines must in cases where fire is employed in them be fixed up outside the theatre building. Fire telegraph: The theatre should be connected with the local fire brigade by telegraphic signalling apparatus which should be accessible not only in the parts of the house frequented by the *personnel* of the theatre, but also in the offices and the porter's lodge. The apparatus should be fixed near the mechanism for moving the fire-proof curtain, and attended to by the watchman looking after the latter. A similar apparatus should be placed in the offices and porter's room. The telegraph must be tested every day about noon, so that in case it should get out of order there may be plenty of time to repair it.

THE BRUSH ELECTRIC LIGHT AT WORCESTER.—The Fine Art Court at the Worcester Industrial Exhibition is illuminated by Brush lamps supplied by the Birmingham and Warwickshire (Brush) Electric Light Company, and the installation is, we understand, giving great satisfaction.

GAS MANAGERS AND THE ELECTRIC LIGHT.—The twenty-first annual meeting of the North British Association of Gas Managers was held in Edinburgh on the 21st inst. The president, in the course of his address said, "it was abundantly evident that cheaper gas must be made and supplied, and to accomplish this their energies must be at once directed. Economy must be the order of the day, and he was persuaded they should not be found lacking in the desire to inquire into and take advantage of such new or improved methods as might be devised and submitted to the profession for use. He did not say this because he feared the electric light, which, so far as he was able to judge, would never become commercially a rival of gas. He would rather hail "the light of the future" as a mission which had taught them what they were capable of accomplishing with gas, as was everywhere apparent in improved lighting. He was satisfied, too, that wherever electricity and gas were brought into competition, it had been well substantiated that gas was able to hold its own, as regarded cost, convenience, or reliability, and even, he would say effectiveness of illumination. At a subsequent meeting Mr. Donaldson described a ventilating globe light. He claimed that where these globes are used, the gas burned in them ventilates the room it illuminates, and in a sanitary point of view is superior to the electric light.

IMPROVEMENTS IN ACCUMULATORS.—In these times of new electrical companies we cannot too strongly recommend to capitalists the particularly ingenious method discovered by M. C. Blanchart, honorary engineer of the mines at Brussels, of obtaining electric accumulators of a capacity far superior to any that have been made at present—on paper, that is. We know that, according to the experiments of Sir W. Thomson, and those of MM. Tresca, Joubert, and Pothier at the Conservatoire des Arts et Métiers, at Paris, the Faure accumulators can store up work equivalent to one horse-power during one hour, with a weight of about 75 to 80 kilogrammes, or 4,000 kilogrammes per kilogramme of accumulators under the most favourable conditions. M. Blanchart arrives at the figure of 11,371 kilogrammes with his improved accumulators. Only—there is an only—M. Blanchart in his calculations only takes into account the weight of the lead and of the minium—the vessel and the acid are not reckoned—and besides, he says that the discharge is effected with a constant electromotive force of 2.15 volts, which is incorrect, since the intensity of the current through an unknown resistance at the commencement of the discharge is 13.33 amperes, and at the end it is only 8 amperes. This change

in the intensity is not produced without a decrease of electro-motive force, but it is convenient not to take this into account in the calculations because it increases the total result. But there is still more to be said. M. Blanchart, by reckoning the weight of the oxidised plates only, and ignoring the fall of potential during the discharge, arrives at the fantastic figure of 23,600 kilogrammetres per kilogramme of active material. It seems to us, however, that the reduced lead which becomes oxidised during the discharge, may also be considered active material. Adopting M. Blanchart's method of calculation, rather less than 12 kilogrammes of active material were sufficient to produce one horse-power-hour of electrical energy. We sincerely hope this is the case, but it is impossible to accept it merely on the calculations of the inventor, who, aiming at simplification, ignores too great an extent important factors. In conclusion, we may add for the benefit of those who may intend to verify our remarks, that M. Blanchart's calculations are given at length in the *Annales de l'Electricité* for July 15th, 1882, page 204.

THE ELECTRIC LIGHT.—Referring to the discussion which took place in the House of Commons on Saturday on the Electric Lighting Bill, the *Daily Chronicle* remarks that the gas companies may claim our sympathy if they are damaged by the new illuminant, but if their pretensions are eclipsed they must be satisfied with sympathy. If the new invention surpasses gas the public interest must override all sentimental ideas about vested interests. The gas companies have no vested interests; they have for many years enjoyed a monopoly in the lighting of public places, but they enjoyed that monopoly for the simple reason that their light was the best which could be procured. The advances made of late years by the electric light have produced a most beneficial effect upon the lighting of the London streets. But the recent exertions of the gas companies cannot prevent the progress of the new illuminant, and we are glad to find that the Government are determined that, so far as they can, they will secure for it a fair trial. Parliament has no right to consider the interests of the gas companies apart from the public convenience, and therefore local authorities will have an opportunity of adopting the new illuminant if they think fit. It would be absurd to suppose that this Bill will dispose of the opposition of vested interests. The electric light will have to fight its own way, and before it gains the goodwill of local authorities it will not only have to prove its superiority, but to overcome the private prejudices which the long-vested interests of gas have planted in every populous part of the country. As to the second objection to the Bill, we do not believe that the local authorities will be found to be at all too ready to rush into expense for the purpose of introducing the electric light. On the contrary, we expect rather to find a disinclination to admit the new illuminant.

CENTRAL AND SOUTH AMERICAN TELEGRAPH COMPANY.—The India-rubber, Gutta-percha and Telegraph Works Company notify the receipt of telegrams from Mr. R. K. Gray, engineer-in-chief, announcing the successful completion of two more sections by the ss. *Silvertown*, namely, from Salina Cruz, near Tehuantepec, Mexico, to Libertad, in San Salvador, and from Libertad to San Juan del Sur, in Nicaragua.

It would appear, therefore, that an alteration in the landing places has taken place. Instead of landing at San José de Guatemala, as was first intended, the Salina Cruz section now lands at Libertad, and thereby brings the republic of San Salvador in the company's system of cables.

The cable was further supposed to have gone from San José to Salinas Bay, in Costa Rica; but this section is now replaced by the Libertad—San Juan del Sur section, and through this the republic of Nicaragua enters the company's system.

Libertad is the principal harbour of San Salvador, and is connected by a good road with the capital, some fifteen miles distant. The capital is the city of San Salvador, founded in 1528, by George Alvarado. The city was, however, repeatedly destroyed by earthquakes and volcanic

eruptions, the last time on April 16th, 1854. The inhabitants then erected new dwellings on a neighbouring site, at present called Nueva San Salvador. But this new capital again was partly destroyed in 1873, by a series of earthquakes and simultaneous eruptions of the neighbouring Tzalco volcano.

Nicaragua is also rich in volcanoes. The old capital of the republic is the city of Leon, some ten miles from the Pacific, surrounded by five active volcanoes, and partly in ruins. At present the seat of the Government is the town of Managua, situated on the southern border of the great lake of the same name. This town is but provisional, being built on the slope of an active volcano, and liable therefore to instant destruction.

No doubt these two countries will open a splendid field for the study of earth currents.

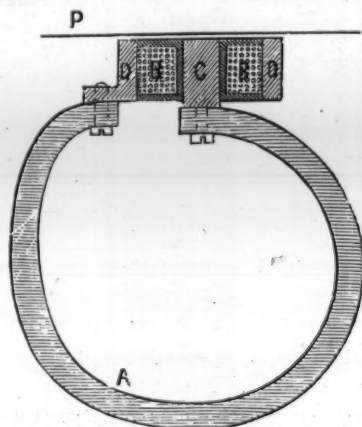
A NEW RED SEA CABLE.—The ss. *Rocheft* was to leave the works of Messrs. Siemens Brothers, on Wednesday, the 26th inst., with the above cable. The contract was made on account of the Turkish Administration of Telegraphs. The length is about 200 nautical miles, and it will be laid from Jeddah, in Turkey, to Souakim, in Egypt. The cable is somewhat similar in type to that of the Black Sea cable of the Eastern Company.

TELEGRAPHIC COMMUNICATION WITH INDIA.—A letter from Colonel F. Burnaby appeared in one of last week's issues of the *Times*, calling attention to the fact, "that in the event of our relations with the Porte being broken off England's telegraphic line of communication with her greatest possession—Hindustan—would be liable at any moment to be cut. Passing, as the wires do, one through Constantinople and Boshore, another through Odessa and Teheran, and the remainder *via* the Delta and India, we are practically dependent upon our friendly relations with the Mahomedan States for our electric communications with Hindustan. The Cape of Good Hope is united by wire with Aden and Bombay; Lisbon is connected with Cape de Verde. Would it not be wise without delay to continue that line through St. Helena to the Cape, thus making us independent of any hostile Mahomedan combination?" In the House of Commons on Friday week, Mr. Leigh asked the Postmaster-General if his attention had been directed to the above letter and if he would take steps to carry out the suggestion and so put our communication beyond the control of hostile Mahomedans? Mr. Fawcett, in answering, stated that the submarine ocean telegraphs are not under the control of the Post-office; that the question forms one of general policy, and that he scarcely felt competent to reply.

THE HOUSE OF COMMONS AND THE TELEPHONE.—In the House of Commons on Thursday week Mr. Shaw-Lefevre, in reply to an interrogation, stated that he would endeavour during the recess to place the House of Commons in telephonic communication with the Telephone Exchange. The only difficulty to encounter was the getting of a suitable room.

M. A. D'ARSONVAL'S TELEPHONE, WITH CIRCULAR MAGNETIC FIELD.—This new form of magnetic telephone was presented by the inventor at the last sitting of the French Physical Society on the 21st of July. M. d'Arsonval was led to adopt this arrangement by studying the effect produced by a wire traversed by an electric current on a double pole telephone (of the Gower, Siemens, or Ader type), without coils. Placing the wire in every position between the poles, internally, laterally, &c., he found as might be expected, that the maximum of effect is obtained when the wire is in that position where the magnetic field is greatest, *i.e.*, between the two poles of the magnet. It is in order to increase the useful part of the wire, which is placed between the arms of the magnet, that the Gower and Ader telephones are furnished with flattened poles. M. d'Arsonval asked himself whether, with a suitable method of coiling, it would not be possible to suppress entirely the outer part of the wire, which introduces into the circuit a supplementary resistance without much useful effect of importance. He effected this by constructing a telephone

with circular magnetic field, similar to Nicklès' electro-magnets. The apparatus shown in the accompanying diagram resembles in its outward form an Ader telephone. The bent magnet, A, forms a handle; on one of the poles is fixed a cylindrical core, C, of soft iron, on the other a ring of soft iron, D, enclosing the first; the coil, B, is placed in the annular space which is left free between these two circular poles. The magnetic field is thus concentrated into the space occupied by the coil, and the lines of force are turned into a direction perpendicular to the wire of the coil. When the telephone is employed as a transmitter, the movements of the plate, P, produce a sort of pivoting



of the lines of force, which gives rise to induction currents. When the telephone is employed as a receiver the undulatory currents which traverse the coil produce a maximum of effect, since they act in that part where the magnetic field is most intense; the modification which they bring to bear on the continuation of the lines of force re-act upon the plate and make it vibrate. With much less weight and a much shorter wire—M. d'Arsonval's telephone weighs 125 grammes, and has only 20 ohms of resistance—we obtain effects as powerful as those produced by the Gower telephone, but with more clearness.

The Gower telephone being furnished with an ear-piece, produces a sound like that heard in a sea-shell, which M. d'Arsonval attributes partly to the too great diameter of the tube and partly to the spiral of metallic wire placed in the tube in order to prevent its becoming flattened. M. d'Arsonval has obviated this difficulty by using a simple tube of gutta-percha eight millimetres (one-third of an inch) in diameter, and thus all resonance is destroyed. It is advantageous in practice to arrange a double tube, one for speaking and the other for hearing.

FRENCH PHYSICAL SOCIETY.—The last sitting of the season took place on Friday, July 21st. The meetings are adjourned during the vacation to November next.

SPECIAL ANNOUNCEMENTS.—We desire to call the attention of our readers to several special announcements at page 10 of supplement.

NEW COMPANY REGISTERED.

ELECTRICAL APPLIANCES SYNDICATE, LIMITED.—Capital £5,000, in £10 shares, with power to increase to £20,000. Objects: To carry on the business of mechanical and electrical engineers and boiler manufacturers of an electric light and power company. Signatories (with one share each): W. Harman, 99, Gresham House; R. Jenkin, 25, Bond Street, Vauxhall; G. S. Ullathorne, C.E., 1, Rutland Road, Hammersmith; S. Crosse, 49, Holland Road, Brixton; R. Soutter, Richmond; H. T. Turner, 106, Vauxhall Bridge Road; H. Ponché, 3, Wilmington Square, W.C. The signatories are to nominate the first directors. Qualification, £100 of share capital. Registered 19th inst. by A. S. Ramskill, 7, Union Court, Old Broad Street.

NEW PATENTS—1882.

3430. "Application of telephones or microphones to pipes or vessels containing and conveying liquids, fluids, gases, and air, for the purpose of detecting leakage therefrom." A. Q. ROSE. (Communicated by F. J. Bell.) Dated July 19.
3433. "Means of operating microphones." P. M. JUSTICE. (Communicated by F. van Rysselberghe.) Dated July 19.
3434. "Electric meters." C. V. BOYS. Dated July 19.
3441. "Apparatus for regulating electric lamps and for measuring electrical currents and electrical energy." A. and F. GRAY. Dated July 20.
3443. "An improved medical battery." W. R. WARREN. (Communicated by G. M. Hopkins.) Dated July 20. *Complete.*
3455. "Dynamo and magneto-electric machinery." J. S. BEEMAN. Dated July 20.
3458. "Telephonic apparatus." J. E. CHASTER. Dated July 20.
3464. "Improvements in secondary batteries or in apparatus for storing electricity." J. H. JOHNSON. (Communicated by J. H. Sutton.) Dated July 21.
3465. "Accumulation and distribution of electricity." L. H. M. SOMMER. Dated July 21.
3466. "Improvements in the means or apparatus for generating electric currents and producing motion by electricity, and for regulating electric currents and making and breaking circuits." C. A. CARUS-WILSON. Dated July 21.
3473. "Apparatus for generating, utilising, and regulating electric currents for lighting and other purposes." A. RECKENZAUN. Dated July 21.
3476. "Chambers and receptacles for electrical apparatus." W. A. BARLOW. (Communicated by L. Encausse.) Dated July 21.
3485. "A new or improved method of and apparatus for telegraphing to and from a railway train in motion." W. B. HEALEY. (Communicated by W. L. Hunt.) Dated July 22.
3504. "A new or improved machine for generating electricity." A. D'ORRELL. Dated July 24.
3508. "Electric lamp." A. M. CLARK. (Communicated by H. J. Müller and A. Levett.) Dated July 24.
3510. "Means and apparatus for obtaining motive power by electricity." J. BARLOW. Dated July 24.
3513. "Telephones." S. BIDWELL. Dated July 25.
3515. "Distributing and diffusing powerful lights." A. P. Trotter. Dated July 25.
3520. "Arc electric lamps." A. L. LINEFF. Dated July 25.
3528. "Secondary batteries, or storage batteries, and method of, and means for, charging and discharging the same." C. E. BUELL. Dated July 25.
3532. "Secondary or polarisation batteries for the storage of electrical energy." G. L. WINCH. Dated July 25.
3534. "Dynamo-electric machines, or electric generators, and electro motors." O. W. F. HILL. Dated July 25.
3544. "An improved electric regulator and meter." W. LAING. Dated July 26.
3547. "Electric cables." J. G. LORRAIN. (Communicated by J. André.) Dated July 26.

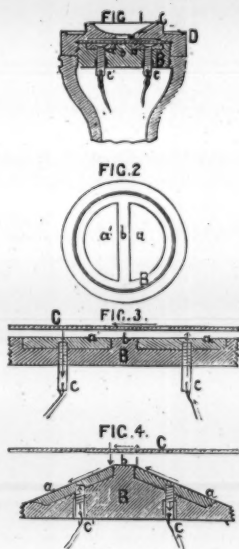
ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1881.

5407. "Manufacture of compounds for electrical insulation." W. ABBOTT and F. FIELD. Dated December 10. 2d. The insulating compound of ozokerit and india-rubber, prepared according to Field and Talling's Patent, No. 1938, of 1875, has the disadvantage of being more or less soft, and therefore not suitable for all purposes. Attempts have been made to vulcanise this compound in the ordinary manner, that is to say, by mixing therewith the vulcanising agents, but this process has been found to deteriorate the insulating properties of the compound and to interfere with its applicability for covering wires. Now according to the present invention the inventors produce a perfectly vulcanised covering for telegraph wires and similar purposes, by first covering the wire with the said compound of ozokerit and india-rubber, and then surrounding such covering with a layer of india-rubber with which an excessive quantity of sulphur or other vulcanising agent has been incorporated; the compound covering so prepared is then subjected to heat such as is usually employed for effecting the vulcanising operation, whereby the compound of ozokerit and india-rubber will become thoroughly vulcanised by means of the excess of vulcanising material in the surrounding covering, resulting in the production of an improved insulating covering consisting of a core or inner layer of vulcanised ozokerit and india-rubber compound surrounded by an outer covering of vulcanised india-rubber. (*Provisional only.*)

5418. "Arrangement of electrical apparatus on railway trains." J. E. LIARDET and T. DONNITHORNE. Dated December 10. 6d. Relates to the arrangement of electrical apparatus on railway trains. The inventors mount dynamo-electric machines upon railway carriages in such manner that the said machines can be set in motion when the train is at a suitable speed and then made to generate electricity, which is stored in secondary batteries and applied when required for lighting the train for signal lights and for propulsion where desired.

5430. "Telephones." A. W. ROSE. Dated December 12. 4d. Consists in the employment of a compound diaphragm, the central portion of which is made of a thin material, and the outer portion of a comparatively thick material, by which is obtained a more effective action of the diaphragm, the thinner portion first yielding to the full extent allowed by its elasticity, and then evoking the action of the thicker portion, which then comes into play, and co-operates with the thinner portion of the compound diaphragm.

5431. "Telephones." A. W. ROSE. Dated December 12. 6d. Relates to the receivers of telephones of that class in which articulate sounds are received by disturbing the static charge of a circuit. One mode of constructing receivers of this description has been to fit two plates or diaphragms at a short distance from each other, in a suitable case, one of such plates being connected with the secondary coil of an induction coil, and the other plate with earth. According to the present invention, the inventor employs a rigid disc, divided into two parts, which are separated by insulating material, and he connects one half of the disc with the secondary wire of an induction coil, and the other half with earth, or with a return wire, when metallic circuits are used. Opposite this divided disc is a metal diaphragm, secured at its edges, and arranged at a short distance from the disc. The secondary current passes from line to one half of the disc across to the diaphragm, and back to the other half of the disc, and thence to earth, or to the return wire, as the case may be. By this means two positive semi-vibrations of the diaphragm are obtained for each electric pulsation, and thus a louder and better articulation from the receiver is obtained. Fig. 1 represents a section



of a telephonic receiver constructed according to the said invention. Fig. 2 is a plan of the same, with the mouthpiece removed. Fig. 3 is a diagrammatic section view, drawn to an enlarged scale, illustrating the direction of the electric current. In figs. 3 and 4 the distance between the divided disc and diaphragm is exaggerated, for the sake of clearness of illustration. a, a' are two rigid half discs of conducting material, which are separated by an insulating strip, b , the latter being either formed in one, with a carrier-piece, n , of non-conducting material, as shown, or attached to the said carrier piece. One of the half-discs, say, for example, the half, a , is connected with the secondary wire of an induction coil by a terminal, c , and the other half-disc, a' , is connected by a terminal, c' , with earth, or with a return wire, when metallic circuits are used. Opposite the two half discs, a, a' , is a metal diaphragm, c , secured at its edges by the mouthpiece, d , so as to be situated in very close proximity to the half discs, a, a' , without being in actual contact. The secondary current passes from the line to the half disc, a (see fig. 3) across to the diaphragm, c , and back to the half disc, a' , and thence to earth, or to the return wire, as the case may be.

5432. "Telephones." A. W. ROSE. Dated December 12. 4d. Relates first to the microphonic transmitter of telephones and consists in the combination with the compound microphone of a thin vibrating diaphragm of mica or other suitable material. The whole of the carbon buttons of the microphone may be placed in contact with this diaphragm, or the central carbon button only may be in contact with the diaphragm, the surrounding carbon buttons being in contact with the frame. When the diaphragm is composed of iron or other conducting material, it should be insulated from the microphone. By the use of a thin vibrating diaphragm in substitution for the rigid wooden board ordinarily employed, the instrument is rendered more sensitive and the strength of the articulations produced at the receiver is greatly increased.

5445. "Galvanic batteries, &c." O. C. D. ROSS. Dated December 13. 4d. Relates to improvements in galvanic batteries and to the application of such batteries to those electric lamps in which the light is produced in a vacuum glass by the incandescence of a continuous carbon conductor or bridge, and the principal object of the invention is to facilitate the use of the recently invented incandescent lamps by a reduced expenditure on plant and in places and circumstances, such as arise in country mansions, &c., and other places where the lamps cannot advantageously be supplied with electricity

by the employment of dynamo electric machines or from secondary storage batteries (Faure's accumulators), which have hitherto been generally considered as the only ways of utilising them. The first part of the invention consists in the construction of a battery occupying but little space, which is very economical and, at the same time, of great power and permanency. The negative and positive elements are platinised broken carbon and amalgamated zinc, which latter is prepared in a comminuted form by pouring it when in a molten condition into water and afterwards amalgamating it in a solution of mercury. Sometimes one or the other of these elements is used in the ordinary form, that is to say, the comminuted zinc is connected with a plate or rod of carbon, or the platinised broken carbon connected with a rod of zinc; and, instead of the ordinary separate cells, a number of cells are combined in a larger vessel, which may be round or square, in which the cells are formed by means of partition slabs, which should be of porous and of impermeable material alternately, or of either of these materials alone. The second part of the invention consists in the combination of galvanic batteries with the above described incandescent lamps, when fitted upon such stems or supporters as will allow of their being shifted about as reading lamps, or of being used as ornamental drawing, or dining room, or hall lamps, or as shop lamps. Any kind of galvanic battery may be employed, but especially such batteries as above named, and batteries in which chromate or bichromate of potash forms the main basis of the solution used to excite either of the zinc and carbon elements. The third part of the invention consists in an arrangement of the vacuum incandescent lamps on their stands, which will allow of their being occasionally taken from the stand and moved from place to place and to a short distance without extinguishing the light. This is effected by attaching a sufficient length of flexible insulated wire between the vacuum glass and the battery, to allow of such removal taking place without interfering with the continuous current of electricity.

5451. "Secondary batteries." J. PITKIN. Dated December 13. 6d. Relates to improvements in secondary batteries or accumulators, and its object is to enable a greater amount of energy to be stored in, and consequently a greater quantity of electricity to be furnished by, electrodes of given dimensions, and at the same time to greatly decrease the weight of the electrodes as compared with that of those formed of plates of lead as usually employed in batteries of this description. The invention consists in forming the electrodes of a mass of very thin turnings or shavings of lead or strips, shreds, or pieces of lead foil or highly laminated sheets of lead in a crumpled condition packed in suitable open frames, preferably of wood or ebonite, and each having a covering of felt, flannel, or other suitable porous material stretched over it on each side to retain the lead in place and allow it to be acted on by the acidulated liquid in which the electrode is immersed.

5452. "Apparatus used in connection with electrical batteries for charging the same, &c." W. R. LAKE. (A communication from abroad by J. F. Aymonnet, of Paris.) Dated December 13. 8d. Relates to apparatus for charging and discharging the liquids in batteries.

5468. "Telegraph or telephone conductors." J. IMRAY. (A communication from abroad by J. M. Stearns, junr., of Brooklyn, America.) Dated December 14. 4d. Relates to the construction and arrangement of cables or grouped conductors for telegraphs or telephones, in such a manner as to prevent the interferences resulting from induction which the passage of an electric current along any one of the group causes in others of the group lying closely adjacent to it. For this purpose a thin sheet of metal, such as copper, having high conductivity, is folded up along with the insulated conductors in a zigzag manner, so that portions of this metal are everywhere interposed between each insulated conductor and those next to it. This metal sheet being at numerous points connected electrically to earth or other discharging conductor, or to the metal pipe in which such cables are often inclosed, carries off induced currents, so that the passage of electricity through any of the grouped conductors does not induce currents in others of the group. Sometimes the insulated conductors are carried in parallel lines along the wall; in such a case the metal sheet can be folded to and fro and passed either in single or in double folds between each adjacent pair and partly round each, and finally over the whole. When the conductors are grouped so as to form a cable, the sheet can in like manner be so undulated or zigzagged as to form a series of loops, each inclosing one of the conductors, which is thus separated by metal from those adjacent to it.

5470. "Galvanic batteries." C. MAURIS. (A communication from abroad by Achille Thomas of Nantes.) Dated December 14. 2d. Has for its object improvements in galvanic batteries. The elements of the battery are of zinc and carbon or it might be of copper or other electro-negative metal. Their form is that of semicircular discs and they (especially the zinc elements) are perforated with numerous holes to increase the area of the surfaces exposed to electrochemical action. The elements are fixed upon an axis from which they are electrically insulated. This axis passes longitudinally through a box or case which is divided interiorly into cells by a number of partitions extending from the bottom up to the axis. Each cell receives two zincs and one carbon or electro-negative element. The box is lined with bituminous cement or otherwise so as to render it water tight. Within each cell or compartment of the box there is a vessel of porous earthenware, into which the carbon or negative element is received, and this vessel has a cover which may be of glazed earthenware. The negative elements are thus enclosed each within its porous vessel and its cover and there is room in the enclosure to permit of the axis turning and carrying the elements round with it. The lower part of the box is charged with sawdust saturated with water acidulated with sulphuric acid. This is in contact with the zincs.

5481. "Secondary batteries." DESMOND GERALD FITZ-GERALD. Dated December 14. 4d. Consists in the use of carbon in conjunction

with lead or compounds of lead, for the electrodes of secondary batteries. In carrying the invention into effect the inventor constructs plates of carbon with perforations, grooves, or recesses which are filled with lead, preferably in a state of fine division, or with any suitable compound of lead. The pores of the carbon also are filled with the same material, which in this case more especially may advantageously be produced by the decomposition of a salt or of an oxide of lead.

5490. "Electric lamps." W. R. LAKE. (A communication from abroad by Jean Auguste Mondos, of Neuilly, France.) Dated December 15. 6d. Relates to electric lamps of that class in which no clockwork is employed for controlling the movement of the carbons, the electric current being utilised for effecting this movement. According to this invention two successive movements are imparted to the carbons, the first being a sudden movement which separates the carbons and causes the electric arc to be developed, and the other a movement which takes place in proportion to the wear of the carbons and maintains them at the proper distance from each other.

5494. "Secondary voltaic cells." J. W. SWAN. Dated December 15. 2d. Has for its object the preparation of lead plates, to be used in the construction of cells for secondary batteries upon the principle proposed by Planté, with a view to diminish the time usually occupied in their preparation. In carrying out the invention, the inventor takes plates of lead of any suitable form, but preferably corrugated, grooved or cellular plates as described in specification 2272, dated May 24, 1881, and exposes them to the combined action of acetic acid, carbonic acid, and atmospheric air, as in the well-known process of making white lead; which action results in the formation of carbonate of lead on the lead plates. This formation may extend to a depth greater or less according to the time such plates are subjected to the vapours and gases. After this action has taken place to a sufficient depth, a portion of the plate being generally allowed to remain unacted upon, the inventor subjects the treated plates to the action of electrolytic hydrogen by making them the cathode of an electric generator (which may either be a voltaic battery, a dynamo or magneto-electric machine, a thermopile or any other suitable electricity generator in a suitable electrolyte). When the carbonate of lead has been transformed into metallic lead by the said electrolytic action, the plates so treated are used in the well-known manner of arranging and using lead plates in the construction and charging and use of Planté secondary cells.

5499. "Measuring and recording electric currents." J. W. SWAN. Dated December 16. 4d. In the patent dated December 1, 1880, No. 5004, the inventor described an electric meter intended chiefly to be used in connection with electric lamps. The apparatus described in the said specification is so constructed that it is necessary to have a pair of wires extending between the meter and each of the lamps. The present invention is in part an improvement in that apparatus, the improvement consisting in the avoidance of the branch wires from individual lamps. The inventor accomplishes this object by taking the main conducting wire, or a shunt from it, round the several electro-magnets, which determine the engagement or disengagement of the intermediate pawls with the counting mechanism and adjusts the springs which counteract the pull of these electro-magnets, so that when the current for the supply of one lamp is passing through the main wire or shunt only one of the magnet armatures will be attracted from its inactive position, and when current is passing for the supply of more than one lamp the number of magnet armatures rendered operative shall correspond with the number of lamps lighted.

5521. "Secondary or polarisation batteries for storage of electric energy." G. GROUT and W. H. JONES. Dated December 17. 4d. The first part of this invention relates to a preparation or combination of lead or other metal with carbon prepared, as hereafter described, to construct the elements of secondary or polarisation batteries for the storage of electric energy. The second part relates to the application of metallic lead dust to be used to cover, to heat around, or compress upon, the blades or plates of whatever nature used as the core or conductor of the elements of these batteries.

5536. "Dynamo-electric machines." J. E. H. GORDON. Dated December 17. 6d. Relates to improvements in dynamo machines and particularly in that described by the inventor in specification No. 78, 1881. In the machine described in that specification the revolving rings each carry the same number of magnet coils as the fixed rings carry armature coils, the drawings annexed to the specification show them as each carrying 16 coils. The armature coils were also made cylindrical and of the same diameter as the magnets, each being placed close to the next. The inventor has found that these coils act on each other by mutual induction in a very injurious manner during the working of the machine. If a certain number of lamps are being maintained by one coil, closing the circuit of the next to it on one side reduces the light of the lamps on the first by some 20 or 30 per cent.; closing the circuit of the next of the other side still further reduces it by a like amount. The reason is that as the currents in contiguous coils circulate in opposite directions they are in the same direction in those parts of the two coils which are immediately contiguous to each other. As the currents in the two coils are both increasing at the same time they retard each other by their mutual action. In the arrangement of the machine which is the subject of the present patent, this drawback is got rid of by making the number of armature coils twice the number of the magnet coils. The magnets therefore act alternately on the alternate set of coils.

5542. "Galvanic battery." W. R. LAKE. (A communication from abroad by La Société Universelle d'Electricité Tommasi, of Paris.) Dated December 17. 6d. Has for its object an improved galvanic battery which is advantageous as compared with other batteries in respect of its small volume, its great effective surface, and its slight internal resistance. The said improved battery works with one liquid only, the copper and zinc elements are separated by a porous diaphragm, and the jar or vessel which encloses the elements of the

battery contains crystals of sulphate of copper; it therefore belongs to the same class as that known as the "Daniell" battery. The invention is based essentially upon two features; that is to say, one feature is the employment of the zinc and copper metals in the form of wires, having a diameter of about 5 to 7 millimetres, twisted spirally or arranged in parallel lines, joined by curves or rounded parts when the vessel used is of square or rectangular form. One extremity of these wires protrudes outside of the said vessel and is bent horizontally to be directly coupled to the corresponding wires of the other elements in order to constitute a battery, which thus can be made up to any quantity and tension desired. The other feature is the replacing of the porous cylinder or vase generally used in the construction of the "Daniell" battery by a sheet of parchment or dyalised paper, arranged horizontally, and the edges of which are plaited or folded, and rise above the level of the liquid contained in the aforesaid jar or vessel.

5551. "Armatures for magneto-electric, &c., machines, &c." J. H. JOHNSON. (A communication from abroad by William Woodnutt Griscom, of Philadelphia.) Dated December 19. 6d. Has especial reference to armatures of the type known as Siemens' armatures, but it is applicable to the poles of all other magnets or armatures, and it consists in dividing the bi-polar extremities of such armatures into two or more sections concentric with each other, one or more of such sections being at such a distance as to utilise the magnetic lines of force which fill the space between the two poles of the field-magnets whilst the other section or sections are arranged so as to pass in close proximity to the poles of the field-magnets and thus utilise the powerful attraction between the poles of the armature and magnet as the one approaches the other. Figs. 1 and 2 represent a transverse section of a magneto-electric dynamo or electro-magnetic armature and a field-magnet respectively constructed according to the said invention. Referring to fig. 1, A is an armature of the

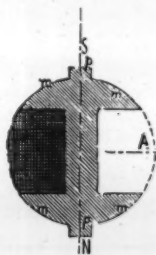


FIG. 1.

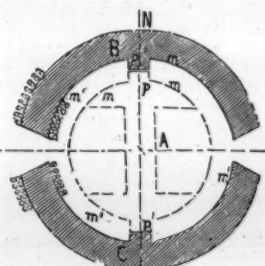


FIG. 2.

before-mentioned type having its bi-polar extremities divided into two or more sections concentric with each other, one or more of such section, *m*, revolving or working at such a distance within the field-magnets, *b* and *c* (see fig. 2), so as to utilise the magnetic lines of force which are generated and disseminated in the magnetic field or space between the two poles of the aforesaid magnets. The other section or sections, *p*, before referred to, are longitudinal ribs or projections concentric with, but extending or protruding above or beyond, the peripheries of the other sections, *m*, so as to pass when the armature is revolving, in closer proximity to the poles of the field-magnets, *b* and *c*, than do the said sections, *m*, so as to economically utilise the lines of magnetic force between the poles of the field-magnet. The interior surfaces of the field-magnets, *b* and *c*, are formed or provided with projecting ribs or pieces, *p'*, arranged so as just to clear the projections, *p*, upon the armature, *A*, when it is revolving. In this manner the poles, *p* and *p'*, are caused to utilise certain magneto- or electro-inductive influences upon the extremely close approach of iron to iron, while the polar surfaces, *m* and *m'*, are arranged for utilising the induced lines of force extending across the magnetic field of the magnets, *b* and *c*.

5566. "Producing electric currents." ADAM MILLAR. Dated December 20. 2d. Relates to improvements in apparatus for producing electric currents, and consists in arrangements for utilising the inductive action which a magnet has upon a conductor forming part of a closed circuit and placed in one part of the magnetic field of the magnet, whenever the magnetism of the magnet is made to vary in intensity by the action in another part of the magnetic field of an armature or another magnet, or of a conductor carrying a current, or of any other body which increases or diminishes the magnetism of the magnet. (Void by reason of the patentee having neglected to file a specification in pursuance of the conditions of the letters patent.)

5573. "Telephones and telegraphs." W. R. LAKE. (A communication from abroad by J. H. Rogers, of America.) Dated December 20. 8d. Relates to a method of secret telephony, or telegraphy, in which two or more circuits are used in such a manner that any one tapping but one of the circuits is unable to obtain anything but a confused and unintelligible series of signals. The said invention also relates to apparatus employed in carrying this method into effect. The said invention is partly based upon the use of an interrupted current as distinguished from a pulsatory current. According to this invention the inventor passes a message sent from any transmitting instrument through two or more circuits alternately in rapid succession. A receiver is placed in each circuit so that the two receivers together give a continuous series of signals, the one supplying what the other omits. The current conveying the message is thrown alternately on each circuit by means of a circuit-breaker which makes and breaks contact with each circuit in succession.

5593. "Dynamo-electric machines." L. S. POWELL. (A communication from abroad by Jean Marie Anatole Gérard Lescuyer, of

Paris.) Dated December 21. 6d. Relates to dynamo-electric machines and it consists in certain improvements in their construction and arrangement. In carrying out this invention, the improved dynamo-electric machine is constructed with a movable inducing part formed by a wheel, say, for example, of brass or gun metal, which is keyed upon a shaft mounted in suitable bearings. A certain number of straight electro-magnets are arranged on the circumference of this wheel in such a manner as to present alternate north and south poles on each side of the wheel. These electro-magnets are connected with a collector on the shaft of the machine communicating through rubbers or brushes with a machine generating direct or continuous currents. The induced part is fixed or stationary, and consists of two series of oval or elliptical coils attached to two rings or frames of iron or copper placed on each side of the inductor. The wire in these coils is wound between two elliptical plates or cheeks connected together by two iron connecting bars and a copper bolt which serves to attach the coils to the rings. The connecting bars nearest to the centre of the machine are preferably angular in cross section and the bars nearest to the outer extremity of the cheeks are preferably circular in section and somewhat thicker than the angular bars. The wire is wound upon these bars in the space between the cheeks. The cheeks facing the inductors or revolving magnets are perforated with a number of holes; but the cheeks which face the rings or frame are imperforated. A thin sheet of metal is interposed between each layer of wire in the coils in order to assist the inducing action and prevent the formation of extra currents. The currents generated in the coils by the passage of the inducing electro-magnets are alternate and may be used separately or may be combined by means of a commutator.

5595. "Electric calls for telephones, &c." A. W. LAKE. (A communication from abroad by W. C. Lockwood, of Brooklyn, America.) Dated December 21. 6d. Relates to telephone calls. In this invention the operating call winds up a spring mechanism.

5599. "Insulated conductors for telegraphic uses, &c." WILLOUGHBY SMITH. Dated December 21. 2d. Has for its object improvements in insulated conductors for telegraphic and other uses. The insulated conductors now used in submarine, subterranean, and other telegraphs consist for the most part of copper wire covered with gutta-percha, and the gutta-percha is used in as pure a state as it can be obtained. Now for this pure material, which is expensive, the inventor substitutes a compound of gutta percha with zinc white.

5604. "Galvanic batteries for electric lighting, &c." E. B. BURN and W. T. SCOTT. Dated December 22. 6d. Has for its object improvements in galvanic batteries for electric lighting and for other purposes. The improved galvanic battery consists of zinc and carbon elements arranged in cells made of wood lined with waterproof cement. The cells are filled around the elements with asbestos fibre, blown slag, or like material, and this is saturated with a mixture of bichromate of potash and phosphoric acid with a little nitric acid added.

5615. "Cables for telephonic and telegraphic communication." J. N. CULBERTSON and J. W. BROWN. Dated December 22. 6d. Has for its object improvements in the construction of cables or collections of metallic conductors for telephonic and telegraphic communication. According to the present invention the inventors employ pipes made in convenient lengths and with perforated insulating discs at each end. The wires in similar lengths are threaded through these discs and such other intermediate insulating discs as it may be convenient to employ and are strained tight.

5623. "Measuring electric currents." C. A. CARUS-WILSON. Dated December 23. 4d. Relates to means or apparatus for measuring electric currents, and it consists essentially in the employment for this purpose of a secondary battery or secondary batteries which, or each of which, is first charged or acted upon by the current to be measured or a part of it, and is then allowed to discharge or run down or has its current reversed, these alternate actions being repeated and made to communicate motion to or regulate the action of any given counting or integrating apparatus. (Provisional only.)

5627. "Electric call signals." H. J. HADDAN. (A communication from abroad by G. W. Foster and F. B. Wilson, both of Paris.) Dated December 23. 2d. The improvements consist of clockwork provided with an escapement in combination with a double helix, furnished with a metallic rod, having an armature on one end, said armature being placed directly in front of the helix for the purpose of being attracted towards said helix by passing a current of electricity through the same. The slightest movement of the armature caused by the current being broken releases the escapement and allows the main spring in the clock-work to run down or unwind and in so unwinding causes a hammer connected with the said clock-work to strike a metal gong and give forth a series of taps or a single tap on the gong to attract the attention of any one in the immediate neighbourhood of the instrument. (Provisional only.)

5631. "Secondary batteries." J. S. SELLON. Dated December 23. 2d. Relates to the construction of the terminal plates, supports, retainers or frames upon and in which the active material or agent is deposited, placed, or fixed. In carrying out this invention the inventor constructs such plates, supports, retainers, or frames of a material or materials not readily subjected to the destructive influence of oxidation or other destructive action, such, for example, as carbon either in a solid form or compressed or mixed or amalgamated with other substances or as asbestos, wood, papier mâché, cellulose, either alone or in combination with metals not easily oxidised, such, for example, as platinum. The plates, supports, retainers, or frames, composed of one or more of these materials, are constructed in the following or other suitable form or forms. For example, they may be made of a cellular, perforated, corrugated, grooved, fluted, roughened, indented, tubular, or woven shape, or any combination of these forms or of any other shape capable of retaining the active material or agent in a finely divided, pasted, deposited, compressed, or other condition.

CITY NOTES.

OLD BROAD STREET.

THE METROPOLITAN (BRUSH) ELECTRIC LIGHT
AND POWER COMPANY (LIMITED).

LAST Monday, at noon, an extraordinary general meeting of the members of this company was held at Cannon Street Hotel, Sir Michael Kennedy, R.E., K.C.S.I., presiding, for the purpose of considering, and, if thought advisable, of passing, as a special resolution the following resolution, or a resolution or resolutions to the following effect, that is to say—

"Resolved—That the Articles of Association of the company be, and the same are hereby altered as follows:—

"(I.) By the insertion in Article 4 after the words 'the directors may,' with which it begins, of the words 'with the sanction of a general meeting.'

"(II.) By the alteration in Articles 81 and 89 of '1886,' therein mentioned, to '1884.'

"(III.) By the omission of Articles 85 and 100."

The secretary (Mr. Robt. Wilson) having read the notice convening the meeting,

The Chairman said: We are assembled here to-day for the special purpose of considering, and, if you think advisable, to pass resolutions making alteration in certain of our Articles of Association. These alterations have been dictated to us by the Committee of the Stock Exchange, who, unless we make the necessary alterations, will not grant us a quotation. And it is very desirable that we should have as little delay as possible before getting a quotation, and the only difficulty which now lies in our way is that which we have met here to-day to overcome. A very few words from me are requisite to make you acquainted with the nature and the scope of the desired alterations. The first is in clause 4 of the Articles, and its object is to prevent the directors, without the sanction of a general meeting, issuing shares at a discount. The alterations in Articles 81 and 89 are merely to reduce the time in which the present board holds office from "1886" to "1884." The next alteration is the omission altogether of clause 85 of the Articles, and the object of that is to secure that all matters of importance which may require the consideration of a general meeting should be discussed in a general meeting, and not be settled by correspondence; the arrangement in the expunging of Article 100 is somewhat similar—to enable matters to be settled by the board and not settled by correspondence. I trust the resolutions to be submitted will commend themselves to you generally. I therefore beg to move the following resolution:—"(1), Resolved that the following words be inserted at the end of Article 4, 'provided always that no shares shall be issued at a discount without the sanction of a general meeting;' (2), that, in lieu of '1886,' occurring in Articles 81 and 89, respectively, '1884' be inserted; (3), that Articles 85 and 100 be, and hereby are expunged."

Mr. Whitehead in seconding the motion, said it was not necessary for him to detain the meeting with any lengthened observations. It would be clear, he thought, to the shareholders present, that the suggestions made to them by the Committee of the Stock Exchange were in themselves very reasonable. They did not interfere adversely with the value of their property, and they would obtain for them an early settlement and quotation, while immediately enhancing the value of their shares in the market. He was sure the resolution would commend itself.

Mr. Wright asked that the chairman would read Articles 85 and 100 as they now stood; and might he ask also if the board could inform the meeting why it was that the shares which were at a premium in May last of 18s. and 15s., were now at 25s. and 30s. discount.

The Chairman having read the articles referred to, said that, as regarded the price of the shares, he was not able to answer that question. He supposed that the reason why their shares did not stand at the premium they formerly did was because they were purchased by speculators.

Mr. Wright said perhaps he put the question rather vaguely. He thought that perhaps the board had some knowledge or some reason amongst themselves in connection with the character of the work being carried on.

The Chairman: I can emphatically deny that the board have any knowledge of the reason why our shares stand at the present rate.

Mr. A. H. Rolls remarked that the shareholders were a little foggy as to what the operations of the company were, and if the chairman could enlighten them he should be glad.

The Chairman remarked that they had met there that day to discuss a special, and come to a special, resolution. However, he had no hesitation in saying that the prospects of the company were very favourable. They were receiving large numbers of orders, were establishing central stations in different parts of the metropolis, and they expected to do a very good business. This was hardly a meeting in which to discuss the question asked. They believed in the "survival of the fittest," they had a good system and a large field. With the assistance of Mr. Hammond, who sat near him, they were pushing the business, and pushing it with very good success. He could not answer every question particularly, but answering generally he must say that their prospects at the present moment were quite as favourable as they could expect them to be under the circumstances. They had not long commenced, and there had been many a difficulty before them. There was a difficulty as regarded legislation, and there was a difficulty with regard to an accumulator. They had been taking steps for overcoming their difficulties, and when they had had a little more time they would be doing a very good business.

Mr. Bischoff read Article 4, and asked if it were not true that all the shares were not already allotted.

The Chairman replied that the whole of the shares were applied for several times over. The whole were allotted. There are, however, a few still unallotted, because certain gentlemen withdrew.

Mr. Bischoff asked if this alteration in Article 4 was merely to conform with the requirements of the Committee of the Stock Exchange?

The Chairman: Entirely.

In reply to a shareholder, the Chairman stated that the number of shares unallotted at the present time was 310.

In reply to Mr. Thomson, the Chairman said that no shares were allowed to be withdrawn after the allotment except in those cases in which the persons were legally entitled to do so.

The resolutions as previously moved and seconded were then put to the meeting and carried unanimously.

The Chairman: We have now disposed of the special business we met to transact to-day, and our first statutory meeting will be held to confirm those resolutions now passed at the earliest possible moment. That will be within one month from the present. A statutory meeting was to be held within four months of the time of registration.

Dr. Pocock said he would like to call attention to one specially valuable feature of the electric light, which he thought might be advantageously dwelt upon in their prospectus, namely, its use in sick chambers, and so on, where it was of particular importance to have a light that would not vitiate the atmosphere. He had a good deal to do with that as a medical man. It frequently happened that a considerable quantity of gas used in lighting passed away unconsumed. In that respect, as well as in its keeping the air of the chamber cool, he had found the electric light far superior to any other source of illumination with which he was acquainted.

Mr. Hammond said that that special feature of the light was referred to in the prospectus, as it was undoubtedly a great advantage.

The proceedings then terminated.

THE ELECTRIC LIGHTING AND MAINTENANCE COMPANY (LIMITED).

On Monday afternoon last a numerously attended statutory general meeting of the above company was held in the City Terminus Hotel, Colonel R. R. Jackson presiding in the absence of the chairman of the company, the directors present being Messrs. Sandeman, Pixley, Norman, Lee, Maudslay, and Young.

The secretary, Mr. F. R. Grigg, having read the notice convening the meeting,

The Chairman said: Gentlemen, I very much regret that Mr. Martin Smith, chairman of the company, owing to a very serious domestic bereavement is unable to attend the meeting to-day. The directors regret it the more because Mr. Smith has a very large pecuniary interest in the company, pays great attention to its policy, and has very strong views as to the lines upon which we ought to work. I regret also that the vice-chairman is absent because he is in America. You are aware that this is a statutory meeting of the company—a meeting called under the requirements of the law—and that there is usually no business whatever transacted at a meeting of this character. The directors of course must adhere to that line as regards the transaction of business, but they feel it their duty to explain the course they have pursued hitherto, and the policy they advocate in the future to the shareholders who are present to-day. The directors have not found it expedient to sink the money intrusted to them so far in the erection of electric installations. They have found that there has been a very great change in the position of the electrical world since they issued their prospectus: there has been an enormous number of new companies created, and the manufacturing companies which at that time held the greatest prominence have adopted the policy of the formation of sub-companies. The result is that instead of there being only about half a million at the disposal of electric light companies, as there was when the prospectus was issued, there are about twelve millions of capital at their command supposing the shareholders respond to the calls that may, in the discretion of their directors, be made upon them. One result of this change in the position of affairs has been that there is a very much larger number of companies prepared to erect apparatus in order to give the public the use of the electric light, whilst the manufacturing power is very little increased. Electrical apparatus, therefore, is excessively dear, and its dearthness interferes with profitable investment for the purpose of electric illumination. Your directors have, therefore, thought that it would be wiser for the time being to look on and to see whether in process of time electrical apparatus will fall in cost so far as to enable this company to buy on advantageous terms. If not, then the directors of the company would possibly recommend to the shareholders the adoption of the policy foreshadowed in one of the later paragraphs of the prospectus, departing to a certain extent from the line indicated generally as the policy of the company, and to start manufacturing. In certain eventualities that in all probability would be the right policy for the company to adopt. I am happy to be able to inform you that the capital of the company is practically intact. 20,034 shares were allotted, and no portion of the money subscribed has been returned, and making provision for the staff of the company for some time to come, and the rent of its offices and all the expenses incurred, a very small amount per share would meet all the liabilities and expenditure so far as yet incurred by the company. The delay of the company in erecting installations has resulted to a certain extent also from a desire to see what the clauses of the Electric Lighting Bill would be. Now there is one of these clauses which it strikes the directors of this company is calculated very much to retard the progress of the electric light, and to cause it to cost a great deal more than it ought to the general public—I mean that clause which enables public bodies to take over the property of electric companies at the expiration of fifteen years, without giving anything for goodwill, and

simply taking the then value of the plant. That seems to me a very absurd provision, because invention as regards the electric lighting is in its infancy. It is very probable that the first apparatus put down may have to be renewed more than once in the course of fifteen years, and if the electric light companies are to charge the public for the use of the light in proportion to the risks run and the expense incurred, the charges must be so great as to prevent the use of the electric light by the general public. The Bill, therefore, seems to be a Bill in its present form which is better calculated to protect the gas companies than aid the development of the new light. I do not think, however, a clause so unjust as that can continue to remain long in the Bill, and I think when the nature of its operations is fully understood by parliament we may reasonably expect that it may be materially altered in the direction of fair play. With reference to the position of the capital of the company, if any questions are asked hereafter, I shall be prepared to answer them with the utmost care, it being the desire of the directors that there should be nothing whatever under any circumstances withheld from the shareholders. To complete what I think it necessary to say to you now, I beg to state that the directors have not taken, and will not take any remuneration whatever for their services until the shareholders receive a dividend (hear, hear). You are aware, I think, because the terms of the prospectus explain that fact, that the preliminary expenditure has been met by the directors—they doing that in consideration of having allotted to them certain founders' shares, which will only be of value after the shareholders receive 6 per cent. (hear, hear). One other subject I may mention before we listen to the remarks of shareholders: there will be no call made in September.

Mr. Geo. Whitley said that the first issue was quoted at one million sterling, and, as an addition, there were £3,000 of what they called founders' shares. Only £200,000 was subscribed. He would like to ask if they thought it quite fair that these £3,000 should be charged to the small fraction of what was originally intended to be £1,000,000.

The Chairman said that he thought the answer to Mr. Whitley's question a very simple one. On the present subscription of £200,000, the profit on the founders' shares was one-third of the profit which would remain after the payment of 6 per cent. If there was no business done there would be nothing to receive, and therefore these shares would be no burden upon the issue. They were issued as fully paid up, and there would be no interest to them in the business of the company until the shareholders received 6 per cent.

Mr. Porter said that the directors wished apparently to give them a clear statement of the position of the company, and the chairman had certainly done so. When the prospectus was originally issued it was supposed that it was proposed to call one million up, and keep it profitably employed. That was at the commencement of the Easter holidays, but the lists were suddenly closed when only £200,000 was collected, and in a circular issued on the 8th April it was stated that the reason of closing the lists was that it was desirable to commence operations at once. They now learned, however, that that was not the case, that nothing had been done within the past three months, that on the contrary the prospect of getting work was very much worse now than it was at that time, because those parent companies, if they might so call them, had given monopolies to subsidiary companies, and therefore an independent company like their own had no apparent prospect of profitable work left. He therefore thought that the question at the present time—though he was merely expressing his own private opinion, having had no conversation on the matter with other shareholders—was whether under the circumstances he had mentioned it was desirable to keep the company going. Whether it would not be better to wind up the company at once. He did not say that in any hostile spirit to the directors. They had done their best, and had the capital still intact, and it had been also stated that they did not wish to receive any remuneration until the company had received a dividend. Nothing could be more fair and straightforward (hear, hear); but still he thought it was still a question whether the reasons he had given did not make it desirable to close the company.

Mr. W. H. Maturin was a little disappointed at the position held by the company and at their not being able to carry out their plans, but he was not surprised at it, the prospect had been so very uncertain, the policy the directors had shadowed out was a very judicious and prudent one, to keep the capital safe in their hands, and not to use it till they could do so advantageously, and only then, as far as they could, with the knowledge and consent of the shareholders. That was a very satisfactory thing for them to consider, and there was another satisfactory thing that the gentlemen connected with the company did not intend to draw any remuneration until the company was a paying concern. He was also glad that they had kept the expenses down to a minimum.

The Chairman said he might add that in regard to the expenses what he wished to convey was that a very small amount per share would meet the expenses already incurred, not that it was their intention to make a call for that purpose.

Mr. Maturin would like to know what amount of money was paid up.

The Chairman said that the amount was £39,918.

Mr. Maturin said he supposed that they were then deriving an income from the investment of that sum. That though it was possible their expectations might not be realised, and that the company might have to wind up, his opinion was that that time had not arrived yet. They did not know what might occur a few months hence, and there might be opportunities to make their company a paying concern. He thought the directors were bound not to incur any expenses whatever beyond what might be paid out of the interest of the money they had, which, doubtless, if advantageously invested, would yield 3½ to 4 per cent. That being the case, and the shareholders knowing that they were incurring no further liabilities, and that their money was perfectly safe in the hands of the directors, they should simply hold it in trust

to see whether a good time would come for employing it. He believed that it was better not to speak of winding up the company, but to leave that to the directors to bring before them at some future time.

Mr. W. Thomson asked if it was a fact that money was returned to any subscribers to shares, on allotment, or at any other time, and if so why was it so returned?

The Chairman said that the simple answer to that was that no money had been returned.

Dr. W. Pocock said that a waiting policy in an affair of this kind which required to be developed and which in the meantime was more or less arrested in its development, showed that the directors had been actuated by a very satisfactory judgment of the position of the company, and he believed the policy was one which recommended itself to all thinking men. The fact of the company not having called up a large amount of capital was an evidence of some doubt in the minds of the board as to the advisability of the course entered upon. They should bear in mind that they were crippled at the outset by legislative proceedings, which had been referred to, which, however, would scarcely stand the light of a very long period without being reversed or at least altered. He believed the policy adopted was the resultant of a very great deal of quiet thought and careful judgment on the part of the directors in the exercise of their functions. They should trust them for the future, and give them support in the careful policy which they had initiated.

Mr. Richard Wilson said that when the company was started a prospectus was issued which invited subscriptions to the amount of £1,000,000, and a statement was subsequently issued that only one-fifth of that had been subscribed. Under ordinary circumstances, when a large sum was invited to be subscribed by the public and it was found that only a small subscription was made, the directors did not usually proceed to the allotment of the shares; and he confessed that when he received the paper stating that the shares had been allotted, he was very much surprised at that departure from the ordinary proceeding in such cases. He quite agreed that it would be better to return the capital.

The Chairman said that the directors would be largely guided by what they found to be the general wish of the body of the shareholders.

Mr. Whitley said that in the original prospectus the objects of the company were put in the forefront as electric lighting and maintenance, and it was a question with him how far they were justified in leaving these and embarking in manufacturing, which was only found at the tail of the articles of association. The main conditions of these articles were now proposed to be left out, and they were going to manufacture and trade on the strength of a little article at the very end of the memoranda of association. He did not think that was fair. The main objects of the company were to have the electric light laid on wherever it was required, and if that failed the object of the company failed to, and it would be far better to wind it up and start a new company for manufacturing.

The Chairman: Gentlemen, I think the shareholders have been extremely fair in the expression of their opinion upon the subject which has been before the meeting. Mr. Porter's remarks were very much to the point. It might be thought, if there was no immediate means of finding profitable employment for the money of the company it would be wiser to return it. It was however thought, as was expressed by Mr. Maturin, that it was better to wait and watch the progress of events for awhile, and see if the policy upon which the company originally was formed was not the right policy, and if circumstances did not so turn round as to enable the directors to employ your capital profitably. The directors' view is entirely in accordance with that of the second speaker. His expression of opinion was remarkably fair, and there was only one point in it upon which I wish to make any comment in an opposite direction. He said that the directors should limit their expenditure to the interest to be derived from the money in their hands, as nearly as possible. That ought to be so, but it is not quite possible, because it is necessary for us to have a staff, to have a certain number of trained men who are constantly looking out and observing what is going on in the electrical world and reporting it to the directors; and then there is the rent of the premises we occupy now. These expenses will come to somewhat more than the interest of the capital in our hands. The amount that the shareholders are already responsible for covers the salary of the engineer for a year, other salaries for six months, the rent of the premises for a whole year, and if we wait for some time—say, six months—very little additional expenditure will be incurred; so that I for my own part and the directors as a whole, favour the waiting policy. One reason why we did not at once invest your money, as we intended to do, was, that although we were offered a great number of installations, and might have invested a great deal of money, when we came to examine the probable result, we did not feel justified in accepting them because there was no adequate profit. That was a disappointment to the directors, but they explained the fact to themselves, as it has been explained to you to-day, and they think there is likely to be a change in the circumstances which will enable them to give the public the benefit of the electric light with advantage to the company and to the shareholders. If it proves not to be so, whatever your resolution to-day, the directors will certainly not risk your money, and would prefer winding up the company. Mr. Whitley, I think, made some observations as to the fact that we asked for a million, and having received £200,000 we still went on with the company. Now I do not see how our receiving applications for £200,000 instead of a million altered our position at all. If our policy was right we could carry it out with £200,000 almost as well as with a million, and if it was wrong then it was better not to have locked up a larger sum of money. So I don't see that the directors were bound when the subscriptions amounted to only one-fifth of what was asked to return the allotment and refuse to proceed with the business of the company. I don't know that any other remarks were made which might require any comments from the chair.

The directors are of course gratified by the expressions of confidence in them, to which Mr. Maturin, Dr. Pocock, and others have given expression, and it will be their endeavour under all circumstances to retain the confidence of the shareholders by acting in accordance with their interests. This being a statutory meeting, it is impossible to pass a resolution, but the directors would like to make use of this opportunity which they have of meeting the shareholders to ascertain their opinion in an informal manner upon one or two points. I will ask those who think the policy of winding up the company is preferable to the policy of waiting, to hold up their hands. [Nine hands were held up.] Nine. Those who prefer a waiting policy, which the directors favour, will please hold up theirs. [A great number of hands were held up.] There is a very large majority in favour of waiting. You must recollect that what we are doing is quite informal.

Mr. Whitley asked whether they had any contracts on hand.

The Chairman said they had not.

Mr. Whitley said that if they adopted a waiting policy would they not then be committed to a lot of contracts before their next meeting?

The Chairman said he must ask for the confidence of the shareholders (hear, hear). He would hardly venture to answer that question, because if they were offered installations that would pay they certainly should invest the money of the company in them.

Mr. Porter said that while they were very much indebted for the courteous manner in which the chairman had replied to their queries, he was sorry that the question had been put so hurriedly. He was going to propose a kind of compromise. He thought they were all satisfied to leave their interests in the hands of the board, but it appeared quite clear that the directors admitted being disappointed in the anticipation of obtaining profitable work, but that also it was well to adopt a waiting policy in view of certain circumstances that might arise. The expenses for the next six months would not be so proportionately heavy as they had been in the past, and it was better to hold their hands and see how things turned up. He would, however, suggest that if in the course of three or four months they were still disappointed in their anticipations of obtaining profitable work, a meeting should be called and the question submitted to the shareholders whether under these circumstances they should go on any longer or not (hear, hear).

The Chairman: There is one question with reference to which we should like to have the informal opinion of the shareholders. I explained to you that the directors thought if electrical apparatus could not be got at a moderate percentage on the cost—if they still continued so high—it might be a wise policy on the part of the company to manufacture their own apparatus. I should like to know what the opinion of the shareholders present is upon that subject, and I would ask those who think that under such circumstances it would be desirable to manufacture such apparatus to hold up their hands.

Mr. Porter: Please don't put that. I do not think this meeting ought to deal with that. I think we should leave that in your hands whether you find it profitable or not. We should leave that entirely to the responsibility of the board (hear, hear).

The Chairman: If that is the opinion of the shareholders of course the directors will take upon themselves the responsibility of acting to the best of their judgment, and giving account to the shareholders at the earliest possible moment afterwards. Still, as we have gone out of the region of strict formality, I thought there might be advantage in arriving at your views on that very important subject. I am glad that you have decided that it is the general view of the shareholders present that it is best to leave that subject in the hands of the directors.

Dr. Pocock said that after the clear and satisfactory statement of the chairman there could not be the slightest hesitation in saying that the board was actuated by feelings which would prompt them to consider the shareholders' interests. He thought they decidedly ought to leave the management of their capital in the hands of the directors to use in the best possible way.

The Chairman: Now, gentlemen, we may consider, if you will, the statutory meeting over, and we will become an extraordinary general meeting, for the purpose of considering and, if thought fit, of passing the following resolution: "That the regulations of the company be altered so as to authorise the company so far to modify the conditions contained in its memorandum of association, as by subdivision of its existing shares, to divide its capital or any part thereof into shares of a smaller amount than £10 each, and that thereupon each of the A shares of £10 each comprised in the capital of the company, stated in the memorandum of association, be divided into two A shares of £5 each; and each of the B shares of £10 each, comprised in the said capital, be divided into two B shares of £5 each." That was a suggestion made to us during the progress of the formation of the company, and it was suggested there would be some advantage in having a £5 rather than a £10 share. I must, however, inform you that that change cannot be made without more or less expense, and I do not see any adequate object to be gained by it under existing circumstances. However, it is within the province of this meeting to propose a resolution on the subject, and I shall be prepared to receive a resolution and submit it to the meeting.

Mr. Maturin asked if it was to be understood that the directors did not recommend the subdivision?

The Chairman said that the directors thought that it was not sufficiently important to justify them in advising the shareholders to make the change.

Mr. George Whitley moved that the regulations of the company be not altered.

Captain S. A. E. Barrow seconded the motion.

The Chairman put the motion to the meeting, and it was carried unanimously.

On the motion of Mr. Porter a vote of thanks to the chairman was passed by acclamation, and the proceedings terminated.

THE INDIA-RUBBER, GUTTA-PERCHA, AND TELEGRAPH WORKS (COMPANY) LIMITED.

The half-yearly general meeting of the above company was held in the Cannon Street Hotel, on the 25th inst., Mr. George Henderson, chairman of the company, in the chair. The secretary, Mr. W. J. Tyler, having read the notice convening the meeting,

The Chairman said: Gentlemen, we do not, as you know, issue any report or statement of accounts for this meeting. I dare say you will be glad to have some information as to what we have been doing for the past six months. I am glad to say that in most departments of our business we have been fairly well employed, and can report an increase of sales, apart from cables, of about £33,000 over the first half of 1881. The market price of our staple material—india-rubber—has considerably advanced, and to meet this, as far as possible, we have raised our selling prices, though not sufficiently to cover the advance. We are doing a good business with our own Government in the departments of the Admiralty, War Office, and Post-office, and have obtained a share of the business arising out of the increased use of electricity. As to cable construction for the half-year, we have executed a second contract with the Mexican Telegraph Company, having manufactured and laid for them a cable of about 275 miles, as an extension of their system in the Gulf of Mexico. This gave employment to our steamer *International*, which after completing that work was engaged to repair one of the International Ocean Telegraph Company's cables between Florida and Cuba. Early in the year we supplied the West India and Panama Telegraph Company with 300 miles of cable, and in May the French Government with 140 miles for the coast of Tunis. The French Government continues to employ us both here and in France. At Persan we are making a considerable quantity of underground cable for it; and at Silvertown we have in hand a second Tunis cable of 260 miles, the laying of which in the autumn will give further employment to our steamer the *International*. The chief work of the year, the Central and South American Cable expedition, has proceeded very satisfactorily. The *Dacia* has returned, having accomplished her share of the work, and the *Silvertown*, according to the latest telegrams from our engineer, Mr. Robert Kaye Gray, is engaged in laying the last section. He expects to have the whole system completed from Vera Cruz to Callao, amounting to over 3,000 miles of cable, by the end of the present month. Happily the expedition has been conducted hitherto without important accident or serious illness, and all our staff have worked cheerfully and energetically in spite of long hours and much exposure in a trying climate. We hope to meet you again in February with a good account of the year. To-day you are called together chiefly to sanction the payment of the usual *ad interim* dividend of 5 per cent. Before concluding, however, I ought to mention that on the dissolution of this meeting an extraordinary general meeting will be held for the purpose of electing an auditor to act in conjunction with Mr. Weise, in the room of Mr. James Cowan, deceased. I have merely now to move that the *ad interim* dividend of 5 per cent., or 10s. per share, free of income-tax, payable on the 26th inst., be now declared.

Mr. S. W. Silver seconded the motion, which was put to the meeting and carried unanimously.

The Chairman said he was perfectly certain that their manager, Mr. Gray, and staff would do everything in their power to conduct the business satisfactorily.

The extraordinary general meeting was then held for the purpose of electing an auditor in the room of Mr. James Cowan, deceased. The secretary having read the convening notice, Mr. Hanson said that he would be very happy to propose for the vacant auditorship a gentleman who he thought would do good suit and service to the company if elected, though he was not offering himself as a candidate. He was a large shareholder, of very good commercial experience, and in early life was accountant in a Joint Stock Bank, so that he ought to know something of accounts. He is now a director of the National Bank of Australasia. He held 216 shares, and therefore had a considerable interest in the status of the company. He begged to move that Mr. Abraham Scott, of 4, Palace Road, Streatham Hill, be elected auditor for the current year in the room of Mr. Cowan, with a remuneration of 30 guineas.

Mr. Randall had great pleasure in seconding the nomination. He regretted very much the loss of the gentleman whose place Mr. Scott was nominated to take.

The Chairman put the motion to the meeting, and it was carried unanimously.

Mr. Scott briefly expressed his thanks for the honour they had done him in electing him to the vacant post; he only hoped he would be able to serve them as well as the gentleman whose loss they so greatly regretted.

Mr. Hanson said that before they separated they owed it as a duty to their directors, to offer them their best thanks for the success that had resulted from their management of the company's affairs. He thought the best proof they could have as to the stability of their position was that very little fluctuation in the value of their property ever took place; whether there was war in Egypt or anywhere else, their property remained very much the same. He begged to move a vote of thanks for the directors.

Mr. Treble seconded the motion, which was passed by acclamation. The Chairman briefly responded, and the proceedings then terminated.

THE EUROPEAN, AMERICAN, CANADIAN, AND ASIATIC CABLE COMPANY.

The prospectus of this company has been issued, and according to it we learn that it "proposes to establish international telegraphy upon a system of mutual profits, and to work at a much lower word-rate than the existing cable companies offer to the public.

"The Act authorises the establishment of telegraphic communication between Sable Island and any other point or points on the shores of the Dominion of Canada that the company may select, and such point or points on the coasts of Great Britain, Ireland, and the Continent of Europe or elsewhere, as the company may determine, and from any point or points on the Pacific coast of the Dominion of Canada to Japan and the Continent of Asia.

"The company has also power, with the consent of the Governor in Council, to connect the cables which are contemplated by the Act with the Government internal telegraphic system of the Dominion or with the lines of any telegraph company in Canada.

"The company starts with a threefold advantage. Firstly, it is free from the dead weight of unproductive capital which has been created in the case of other companies to the extent of some millions sterling, owing to several of their Atlantic cables having been abandoned, or rendered unserviceable; secondly, it has all the advantages of experience acquired in construction and laying by former companies; and, thirdly, instead of starting with over-costly and short-lived cables, it has entered into a contract with the well-known Henley's Telegraph Works Company, Limited, for laying down about 6,120 miles of cables, comprising two complete cables between England and Sable Island, and connections with Canada and the United States, at an agreed price of £1,443,176.

"This contract will place the company in a very favourable position as compared with existing cable companies, as is shown by the following facts:—

"The Anglo-American Telegraph Company, Limited, with a capital of £7,000,000, has three cables in working order, and it is said a fourth has been recovered and repaired; the Direct United States Cable Company, Limited, with a capital of £1,300,000, has only one cable; the French Atlantic Cable Company, with a capital of £1,700,000, has only one cable; thus showing five cables representing a capital of £10,000,000. It will further be noticed that this company will have two separate cables across the Atlantic, thereby rendering it independent of external aid, a feature of such self-evident importance that it is not necessary to dwell upon it any further.

"The life of such cables as it is proposed to lay may be safely taken at not less than 20 years, and provision for complete renewal at the end of that time should be ample.

"The company has therefore decided upon carrying on business at uniform low rates, instead of pursuing the vacillating policy hitherto in vogue of tentative reductions, with alternating augmentations.

"A tariff of 9d. per word between England and New York and Eastern Canada will be adopted, which, if necessary or advisable, can be reduced to even a lower figure. (The present rate of the combined companies is 2s. per word.)

"Experience has shown that the existing companies are unable to work profitably at a tariff of 1s. per word. This company will, therefore, doubtless obtain as much of the traffic as its cables will be able to carry.

"It is computed that the entire working capacity of the proposed cables is equal to the transmission of about 14,000,000 paying words, during 300 full working days, but taking 10,000,000 words as a reasonable average, and allowing £80,000 for working and other expenses, according to careful estimates, the net returns would read as follows:—Gross revenue, 10,000,000 words at 9d., £375,000; less renewal fund, £45,000, and working expenses, £80,000, £125,000; leaving a net profit of £250,000, or equal to about 17 per cent. on the company's capital."

Since the prospectus appeared a letter has been addressed to the editors of the various newspapers by Mr. Weaver, of the Anglo-American Telegraph Company, and on the following day a reply was sent by Mr. S. Leith Tomkins, the secretary of the new company. They are very interesting, but as we hope to deal with the whole subject fully in an early issue, we do not intend publishing them, but shall refer to the leading parts of them when reviewing the subject in detail.

THE GLOBE TELEGRAPH AND TRUST COMPANY (LIMITED.)

The ninth ordinary general meeting of the above company was held on Thursday the 27th inst., in the City Terminus Hotel, Cannon Street, Mr. John Pender, M.P., chairman of the company, presiding.

The Secretary, Mr. William Payton, having read the notice convening the meeting, and also the minutes of last meeting, the latter were approved and signed.

The Chairman said: Gentlemen, I presume you will take the report as read (agreed). Before I make any remarks generally upon the present state of telegraphy, I will preface them by referring to a little of the detail which has been carried on during the last twelve months. I want first to call attention to the fact that we have not been inactive during the past year, and have been enabled to make some tangible exchanges, which it is believed will be for the benefit of the company. The proprietors should remember that these exchanges are made mainly in the interests of the shareholders. The wider the basis of our operations, the more we can exchange on proper terms so as to extend the range of our securities, and the greater interest ordinary shareholders obtain. We have had a very large holding in the German Union Telegraph and Trust Company—£180,000, which company is the agent of the German Union Telegraph Company, Berlin. The company found it necessary, in the interest of the growing traffic and to avert competition, to lay a second cable from Embden to Valencia, so as to secure direct cable communication from the German Telegraph Union to Ireland without passing through the country, as formerly. You are aware that the French had a certain *esprit de corps*; and the Germans, of course, seem to have taken the same idea; and to meet the requirements of the growing traffic, they thought it better to have their own direct line from Germany. That cable has been made and laid, involving a duplication of the capital

of the Berlin company, and they issued $5\frac{1}{2}$ per cent. preference shares. Your directors thought it well, having regard to the large holding of ordinary stock represented by the trust shares, to secure not only a rateable number of the $5\frac{1}{2}$ per cent. shares. The directors felt it essential to cover the risk of the German Union by accepting these preference shares, which, no doubt, are of quite good security; for the German Union paid 10 per cent. for the year 1880, and $8\frac{1}{2}$ per cent. for the year 1881, and the prospects are now better than they have been. The purchase being large, involving something like £140,000, the available cash balance of this company and the trust certificates were applied to this purchase, and we also had to borrow £18,000, which is the extent of our liability in this purchase. We have been enabled to acquire preference shares at a price which will give $5\frac{1}{2}$ or, say, 6 per cent. for our preference and $4\frac{1}{2}$ for our ordinary shares. We have acquired also a parcel of German Union Telegraph cable shares, and have exchanged 500 Indo-European shares for our shares on favourable terms, and also 1,000 Eastern Telegraph shares. The Indo-European and the Eastern we look upon as a very valuable property. We declared, in the year '80 and '81, dividends on the ordinary shares of $4\frac{1}{2}$ per cent., and your board regret to have to show a falling off from this rate of interest. It is a small falling off, but they hope they will very soon recover it. It is attributable to one cause only, that is, the competition in the Atlantic. In the financial year ending July, 1881, we received $3\frac{1}{2}$ per cent. from the Anglo-American Company, making the sum of £36,400; during the last financial year, ending July, 1882, we only received $2\frac{1}{2}$ per cent., or £30,800, a difference of £5,600. This is the main reason why the dividend is diminished. The two shilling tariff now in force is bringing in such an amount that I am hopeful that the next dividend of the Anglo-American will be such as to enable us to recover the dividend paid last year. In regard to the expenditure, there is very little difference as to the result of the year, and we give full details of our very modest outlays. When we made exchanges of shares in the ordinary course of business from time to time, we applied to the Committee of the Stock Exchange for an extension of the quotation, so as to embrace the number of shares issued and keep our quotation and issue in perfect order. The number of shareholders is still on the increase, and I presume we may take it as an evidence of the popularity of the security which the company offers, that while last year it reached the large number of 5,800, to-day the number of shareholders is 6,250. Since last I met you here our friend and colleague, the Right Hon. W. N. Massey, has passed away, and in him we have lost a man of very good sound sense. He was associated with the Globe Company from its very commencement, and his death is a loss which we all deeply regret. We have appointed in his place at the board Mr. Henry Daniel Gooch, son of Sir Daniel Gooch, whose name is honourably associated with submarine telegraphy. Mr. Gooch has also had some experience of a telegraph company, and therefore we have in him a younger life and a valuable accession to the board. Mr. Newmarsh, one of our auditors, has also passed away. His reputation was world-wide, and every one who saw his name was satisfied that the work he had to do was accompanied with the highest sense of honour. We have appointed in his place—or, rather, the shareholders at the last meeting were unanimous in appointing—Mr. William Griffith, B.A., Barrister-at-Law. So far as I have had an opportunity of observing, Mr. Griffith has been very careful indeed in seeing that the accounts of the company are in proper order. Now I have to make a few general remarks. In the first place I may refer to the Anglo-American competition in the Atlantic. I dare say you have read in the newspapers the prospectus of the company which was launched last Saturday, and seen the report of the managing director—or rather the criticism of the managing director—of the Anglo Company. That is so complete that I need scarcely add one word. The only thing I may say is that it does astonish me in a great commercial city that such a prospectus should have been seen. It is such that the men who have prepared it, and I am afraid, many of the honourable names associated with it, had not in the slightest degree a knowledge of what it implies. I can only say this, that if the company is floated—which I have considerable doubts about indeed—it would be literally impossible for them to realise what they put forward in their prospectus. A grave responsibility, therefore, rests upon those who have issued this prospectus, a responsibility so great, that I am perfectly satisfied that when many of the names associated with it begin to realise their responsibility, the result will be that there is very little chance of its proceeding beyond the paper in which the proposal has been made. However, that is a thought resting entirely with those gentlemen. Just one point I may mention, as showing how extraordinary the statements are. They assume that notwithstanding the eight cables which we have now in the Atlantic, these eight cables being capable, when in good working order, of doing the work of sixteen cables, this new company assumes in their prospectus and in their calculations that they will do not only all the traffic that the other companies do, but something more than all the traffic that is obtained in the Atlantic at the present. I think you will see at a glance that the old companies must be in a very extraordinary state if they stand still and see their business passing away. But as to the cable that they intend to put down, it would be simply impossible for them to do their work. They assume that they will do twenty-five words a minute. Sir James Anderson, who has had great experience of what the best manipulators can do, will tell you that sixteen words a minute is uncommonly good work. Therefore the whole statement throughout is one that, I am sorry to say, shows the greatest ignorance on the part of those who concocted it—and I think it is using a mild phrase to call it ignorance. Probably they would not be able to work their system at more than ten words a minute. Therefore, so far as I can say, and looking carefully into the figures, the chances are, that instead of showing a profit, a loss to such a company would accrue of nearly £50,000. There is another cable which is projected by Mr. Garrett, of the Baltimore and Ohio Company. I am making these remarks, for, as you know, you obtain good dividend from the existing companies, and these

might be affected by such new enterprises. His scheme is to utilise, as far as possible, the telegraphs along a very extended and very important system of railway in America—the Baltimore and Ohio Railway. The Baltimore and Ohio Company have not themselves obtained an Act of Parliament at Washington for new lines, but the members connected with the system have obtained this act. My own impression is that the men connected with this company are shrewd men, not likely to get any money in America, if they can get it in England, and are quite justified in getting this addition to their system. But my own impression is that while our telegraph lines generally are at 50 per cent. discount that is not likely to be realised. I think there is a probability that even Mr. Garrett, shrewd man as he is, will reconsider the question before he even induces his friends to go into this large expenditure. I think that now, with a working power which is represented by something like 16 cables in the Atlantic with the duplex system, I think it is possible to provide Mr. Garrett's system with as much cable power as he requires for operations in America, and, therefore, as I have always been a man of peace with regard to submarine telegraphy, I have always thought it better that there should be combination rather than fighting with one another, because in the long run compromises have to be made. I am hopeful that before I have the pleasure of seeing you again we shall have some means whereby we can utilise Mr. Garrett's system by gradually improving our own. The next system that I must refer to is that of the Eastern system of telegraphy and its Eastern Extension. I dare say you are all aware of what is going on in Egypt at the present moment, and probably no company is more prominently before the public engaged in doing good and useful work for the community at large than that company. Had it not been for the arrangements made by the Eastern Telegraph Company we should have been, I believe, without any communication with Egypt to-day. I am sorry to say we have not to thank the Government very much for providing us with anything. We have provided the Government with means for securing a rapid, and perhaps the best, working system of telegraphy between Egypt and Europe at the present. That has been done entirely by forethought, by bringing a ship, at very considerable expense, from the Red Sea to Alexandria, establishing on board that ship our working system, so as to keep the public informed as to all that is going on in these waters; so that every hour in the day when the newspapers bring out a fresh edition, that fresh edition springs entirely from the telegraphic communication established by the Eastern Company. We have at the moment an interruption to our system in crossing the Isthmus of Suez. I am sorry that interruption should exist. If we had had our own way it would never have existed, and I hope that we shall be, before very long, able to show the Government that the Indian Empire is of some consequence to England, and that England should not be backward in retaining good telegraphic communication, which is so valuable at the present. I say this without fear of contradiction: if the system of telegraphy was suspended for one week between England and India I dread what the consequences would be. If it were suspended at the present, any dilatoriness or delay of our Government in giving the instructions would have serious results. There is another system working to India, that is the Indo-European system. That is a valuable system in its way. We, I may tell you, are partners in that system, and therefore at the present moment we are not losers to any serious extent by the interruption of our system; but I think it is desirable that England and India should not be entirely dependent upon this one line, which passes at the present moment through Germany, Russia, Persia, and the Persian Gulf. Only yesterday one cable in the Persian Gulf was interrupted, another might be to-morrow, consequently an alternative line is desirable. That, we have in full working order; but we are working in perfect harmony with that system, forming an arm of the general system, and for the present moment of a system still forming a connection, but an uncertain one, between England and Persia. I am hopeful that before long we shall be able to communicate again with India by the Suez Canal. We, of the Globe Company, as advisers to the other companies, and as being interested in these other companies, made it our special business to see Government almost daily on the subject, and we urged on them the importance of having this communication re-established with India and Europe. With these remarks I beg to move that the report and accounts of the directors submitted to the meeting be, and hereby are, received and adopted, and the following dividends be declared payable this day, 3s. on the preference shares, being 6 per cent. for the year ending 18th July, 1882, and 2s. 9d. on the ordinary shares, making $4\frac{1}{2}$ per cent. for the year ending the same date, both free from income-tax.

The Marquis of Tweeddale seconded the motion, which was carried unanimously.

The Chairman: The next resolution is that the Marquis of Tweeddale be, and hereby is, re-elected a director of this company.

The motion was seconded by Sir James Anderson, and carried unanimously.

The Chairman: I have also to move that Mr. Henry Daniel Gooch be and hereby is re-elected a director of this company.

Mr. W. Ford seconded the motion, which was likewise unanimously carried.

The Marquis of Tweeddale and Mr. Gooch having briefly thanked the shareholders for their re-appointment, Dr. W. F. Gredge moved that J. G. Griffiths, Esq., F.C.A., and W. Griffith, Esq., B.A., be re-elected auditors of the company, at a remuneration of thirty guineas.

Mr. Scott seconded the motion, which was put to the meeting by the Chairman, and carried unanimously.

Mr. Griffiths briefly expressed his thanks to the meeting.

A vote of thanks to the chairman was then moved by Mr. Gardner, seconded by Mr. Benson, and carried by acclamation.

Mr. Pender responded.

The proceedings then terminated.

EDISON ELECTRIC LIGHT COMPANY

(LIMITED).

The Public are informed that the above Company, whose registered Offices are at

74, COLEMAN STREET, E.C.,

ARE THE SOLE ASSIGNEES OF ALL

Mr. EDISON'S PATENTS FOR ELECTRIC LIGHT AND POWER
IN THIS COUNTRY.

The Company is advised that these Patents secure to it the sole right to manufacture and sell the INCANDESCENT LAMP consisting of a Carbon Filament in a Vacuum, under whatever name that Lamp may be known.

The Company is prepared to enter into Contracts for

LIGHTING HOUSES, FACTORIES, STREETS, AND TOWNS,

On any scale, and to grant concessions to District Companies for the use of the Patents.

CALLENDER'S **BITUMEN, TELEGRAPH AND WATERPROOF CO.** LIMITED.

101, LEADENHALL STREET, LONDON. Works—ERITH, KENT.

Manufacturers of Insulated Wire for the Transmission of Electricity
for all purposes,

TELEGRAPHS, TELEPHONES, ELECTRIC LIGHTING, TRANSMISSION OF POWER, &c.,

At a price greatly below that of Gutta-percha or India-rubber.

RAMSDEN, CAMM & CO
Iron & Steel Wire Drawers &
GALVANIZERS

MANUFACTURERS
OF
PATENT TELEGRAPH
WIRE
TO GOVERNMENT
SPECIFICATIONS.
BEST REFINED
TELEPHONE WIRE.
FENCING WIRE.
SUBMARINE
CABLE WIRE.
STRAND & STAY WIRE
AND
GALVANIZED
BINDING WIRE

BRIDGEHOUSE
YORKSHIRE
CONTRACTORS TO H. M. POSTMASTER GENERAL

TRADE MARK
REGISTERED
OVER
100 YEARS
WITHOUT
A WELD
OR
JOINT



London Offices—72, KING WILLIAM STREET. Agents, G. W. SHARE & Co.

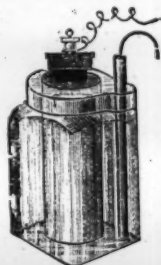
J. ORME & CO.,

MANUFACTURERS & IMPORTERS.

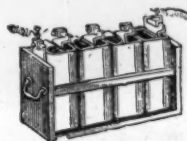
ELECTRIC BELLS AND BATTERIES.



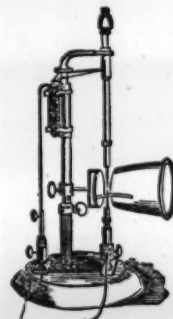
9/6



3/6 to 6/-



£1 15 0



£2 2 0

Every Description of Electrical Apparatus for Science Classes.

CARBON TRANSMITTERS

For use with Telephones, with Automatic Switch, &c., per pair, £3 6 0. Hunnings' Patent Carbon Transmitters, per pair £5.

ILLUSTRATED PRICE LIST OF ELECTRICAL APPARATUS, POST FREE, THREE STAMPS.

Price List of Chemical Apparatus with 650 Illustrations, post free, 8 stamps.

J. ORME & Co. (Late M. JACKSON & Co.),
65, BARBICAN, LONDON, E.C.

SIR WILLIAM THOMSON'S PATENT GRADED GALVANOMETERS

MR. JAMES WHITE, 241, Sauchiehall Street, Glasgow, is now prepared to supply GALVANOMETERS constructed in accordance with Sir William Thomson's Patent, December, 1881. These instruments are portable Galvanometers of two classes: one designed for measuring electric currents and the other for measuring electric potential. The Current Galvanometer measures currents of from 0.01 of an ampère to 100 ampères. The Potential Galvanometer measures differences of potential from 0.1 of a volt to 200 volts.

PRICES.

Potential Galvanometer, with controlling magnets and flexible electrodes	-	-	£20 0 0
Current Galvanometer, ditto	-	-	15 0 0

THE HAMMOND COMPANY ELECTRICAL ENGINEERING COLLEGE, LONDON.

Laboratory and Lecture Rooms, 2, RED LION SQUARE, W.C.

Principal—HUGH ERAT HARRISON, B.Sc. (Lond.).
Electrical Engineer—FREDERICK C. PHILLIPS.

The Course of Instruction will consist of a Series of Lectures on ELECTRICITY and MAGNETISM, which will not merely embrace all the ordinary and generally known Electrical and Magnetic Phenomena, but will extend to portions of the subject not included in the Syllabus of the existing Scientific Schools, and to which attention has recently been directed by the late extraordinary growth of Electrical Engineering; a Series of Lectures on PHYSICS and CHEMISTRY, without an efficient knowledge of which the higher branches of Electricity and Magnetism cannot be properly understood; and of instruction in Mechanics and Mechanical and Geometrical Drawing such as is necessary for Electric Lighting and Telegraph Construction work.

The LABORATORY of the College will contain, in addition to all ordinary Physical and Chemical Apparatus, Dynamo Machines, &c., of various types, and an Engine to drive them. The Premium Apprentices of the Company will repeat for themselves all the experiments shown at the Lectures, will be instructed practically to perform all Electrical and General Physical Measurement and Tests with the utmost accuracy, and, by having constantly before them several entire systems of Electric Lighting Plant complete with driving-power, they will acquire such a practical insight into the practice of their profession as to render their services equally valuable to any of the various Electric Lighting and Power Companies or Electrical Engineering firms.

Apprentices, when sufficiently advanced, will be employed to assist in the carrying out of the various Contracts of the Hammond Company, under the direction and personal supervision of Mr. F. C. PHILLIPS. The Company in extending its operations will necessarily require an increasing number of Electrical Engineers of the higher grade, and will give the first offer of employment to its own Apprentices.

The more advanced Apprentices will also be allowed, towards the end of their Time, to carry out original research; and should they obtain any useful results, due recognition will be made by the Company.

Further particulars may be obtained from Mr. PHILIP A. LATHAM, Secretary, at the Offices of the Company, 116, Cannon Street, E.C.

First Prize Medals Paris and Philadelphia, 1881.

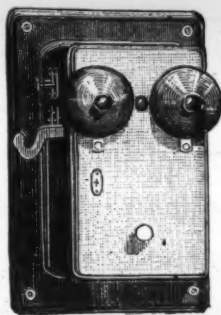
GRISCOM'S ELECTRO-MOTOR & AUTOMATIC BATTERY.

Complete Apparatus for Driving any Sewing Machine,
Dental Lathe, &c., 5 Guineas.

Delivered free in London.

The Electro Dynamic Company,
2, SCOTT'S YARD, BUSH LANE,
CANNON STREET, LONDON, E.C.

PRIZE MEDAL, PARIS, 1881.



BLAKEY, EMMOTT, & Co.,
NORTHERN TELEGRAPH WORKS,
HALIFAX.

LONDON & PARIS.

Manufacturers of Magneto
Call Bells, as used by the
Principal Telephone Com-
panies, also Switch Boards,
Switches, and all Instru-
ments for Telephone Work.

PRICES ON APPLICATION.

PATENT OFFICE RESEARCHES.

TO ELECTRICAL INVENTORS and OTHERS.—
An OXFORD GRADUATE, experienced in electrical subjects,
and in the investigation of scientific books and documents, under-
takes confidential researches. Not being a Patent Agent, he has no
interests but that of his clients in determining the exact scientific and
commercial position of all matters submitted.—Address, "B. X.,"
care of Editor ELECTRICAL REVIEW.

ELECTRICITY versus GAS.—PUBLIC EXHIBITION of the
FITZGERALD INCANDESCENT and GUMPEL ARC LAMPS, intro-
ducing a novel mode of Street Lighting by the PHOENIX ELECTRIC LIGHT
and POWER COMPANY, LIMITED, at 190, Westminster Bridge Road, London,
S.W.

ELECTRIC SHIP STEERING.

A Model will also be on view and in full operation illustrating a novel method
of steering ships by electricity, whereby the captain is enabled to direct person-
ally and from the bridge the course of his vessel.

The serious accidents occasioned to ships at critical moments by a misun-
derstanding of the commander's orders (as, for instance, in the case of the German
ironclad *Grosser Kurfürst*), will be prevented by the application of this
apparatus, the system being as infallible as the block system employed on all the
principal railways. All interested in the commercial application of electricity
are cordially invited. No cards of admission will be necessary.

By order of the Phoenix Electric Light and Power Company, Limited.

W. DUNLOP, Secretary.

THE SCHOOL OF TELEGRAPHY AND ELECTRICAL ENGINEERING.

ESTABLISHED IN 1868.

12, PRINCES STREET, CORNER OF HANOVER SQUARE, LONDON, W.
(Removed from 4, George Street, Hanover Square). Managing Director: **Mr. T. J. JONES, M.S.T.E.**

The course of Practical and Theoretical Instruction in the higher branches of Overland and Submarine Telegraphy embraces, in addition
to the manipulation of the various systems of wording in general use, the following subjects:—Mathematics, Mechanics, Chemistry in relation
to Telegraphy, Gas and other Motors. Signalling and Testing Instruments. Engineering Formulae and their application in practice.
Electro-Statics. Electro-Dynamics. Magnetism. Methods of Testing the Electrical Condition of a Line during and after its Construction.
Testing for and Localising Faults, &c., &c., &c. Telephone and Electric Light Apparatus.

The instruction, both in signalling and testing, is of a thoroughly practical character, as the classes work with the actual instruments used on long lines, through cables
of various lengths, from 600 to 3,000 knots, so that the signals of the Eastern, Atlantic, and Brazilian Co's, &c., are exactly reproduced, and the pupils fitted for any line.

A complete practical and theoretical course of instruction on the TELEPHONE and the ELECTRIC LIGHT, and their commercial utilisation, has now been
added to, and embodied in, the ordinary curriculum, as the advantages of being associated with any great commercial application of science at an early period of its
development is one which has been so often exemplified that it can scarcely fail to be appreciated by those who have in view professional success.

That TELEPHONIC communication and ELECTRIC LIGHTING constitute such applications is sufficiently shown by their rapidly increasing
progress; and therefore no pains or expense have been spared to place at the disposal of the pupils the technical and scientific instruction requisite to qualify candidates
for the most important posts in connection with these new branches of electrical engineering. In order that the instruction in the erection, adjustment, testing, and
working of TELEPHONE and ELECTRIC LIGHT circuits may also be thoroughly practical, complete working telephone exchanges upon the various
systems in use in different countries have been fitted up; every kind of telephone, for both exchange systems and private lines, with all apparatus used therewith, is
provided (in duplicate when possible, so that students may be able to dissect and reconstruct the same). The necessary tools and materials are available, and every
facility is given for conducting experiments by the pupils desirous of so doing, and a similar course has been pursued with the **VARIOUS LAMPS and**
MACHINES, &c., in the ELECTRIC LIGHT Department, so that pupils from the School are in a position to enter either of these new fields. Civil and
mechanical engineers, sons of professional gentlemen, and others, will now have an opportunity of acquiring a knowledge of all the telegraphic systems of working, of
the construction and management of land and submarine telegraphs, of telephone lines, systems and exchange, of the construction, erection, and management of
electric light apparatus, testing wires, lines and materials employed, submarine cable testing, localising faults, &c., &c.

Arrangements have been made so that Inventors, Amateurs and others can now have every facility, with all necessary apparatus provided in private rooms, to com-
pare, test or perfect any Inventions, Apparatus, &c., connected with Telegraphy, Telephony, and the Electric Light. The highest professional assistance can also be had,
Further particulars may be obtained on application to
W. N. TIDY, Secretary.



THE RAILWAY SUPPLIES JOURNAL.

STORE-KEEPERS' GAZETTE;
Manufacturers', Inventors', and Contractors'
Record; and Railway, Shipping, Tramway, &
Mining Advertiser.

Principal Editions on the 1st and 15th of each Month.
Price Sixpence.

THE RAILWAY SUPPLIES JOURNAL is specially intended to bring
under the notice of Railway Companies the various inventions, im-
provements, and supplies demanded by the numerous requirements of
the Railway Service; and generally to form a medium of communica-
tion between Railway Companies and those who supply them with
materials, goods, or appliances.—*Times.*

OFFICE—

5, WINE OFFICE COURT, FLEET ST., LONDON, E.C.

L'ELECTRICIEN: GENERAL ELECTRICAL REVIEW.

Published the 1st and 15th of every Month.

SUBSCRIPTION:—£1 PER ANNUM, INCLUDING POSTAGE.

COMMITTEE OF REDACTION:—

Messrs. Ch. Bontemps, C. M. Gariel, A. Naudet, Dr. de Cyon, and Gaston Tissandier.

SECRETARY OF REDACTION:—

Mr. E. Hospitaller, Engineer of Arts and Manufactures.

REDACTION:—25, AVENUE DE L'OPERA, PARIS.

ADMINISTRATION:—120, BOULEVARD ST. GERMAIN, PARIS.

ENGLISH CORRESPONDENT AND AGENT:—

J. A. BERLY, C.E., A.S.T.E., &c.,

16, NEW BRIDGE ST., BLACKFRIARS, LONDON, E.C.

ASSISTANT ELECTRICAL ENGINEER
WANTED in London to devote his whole time to the work. Salary to commence at £300 per annum.—Apply by letter, enclosing testimonials, &c., to Professors AYRTON and PERRY, St. Stephens Chambers, Telegraph Street, E.C.

WANTED at once some thoroughly good LATHES, MILLING MACHINES, and other Tools, either new or second-hand, suitable for turning out high-class Brass work used in Arc Electric Lamps.—Apply to RANSOME, JOSSELYN, and WOODS, Battersea Foundry, London, S.W.

IMPROVED STEEL WIRE FOR ROPES.

WEBSTER, HORSFALL & LEAN

(ORIGINAL PATENTEES).

MANUFACTURERS OF IMPROVED STEEL WIRE FOR ROPES FOR COLLIERIES,
RAILWAY INCLINES, PLOUGHS, HAWSERS, &c.

Sole Manufacturers of the Homogeneous Wire for the Atlantic Cables of 1865 and 1866.

WEBSTER, HORSFALL & LEAN, BIRMINGHAM.

N.B.—Noted for "Sounding" Wire for Deep-sea Sounding, Telephones, &c.

THE

LONDON ELECTRIC WIRE COMPANY,

WENLOCK BUILDINGS, IRONMONGER ROW, OLD STREET, LONDON, E.C.,

Manufacturers of Covered Wires of all descriptions for Electrical Instruments, Dynamo Machines, Bell & House work, &c.

Fancy Paraffined Wires specially prepared for Telephone and other indoor connections.

HARRISON, COX-WALKER & CO., DARLINGTON,

ELECTRICIANS, TELEPHONE AND PNEUMATIC ENGINEERS, MINING BELL MANUFACTURERS,
Agents for

HUNNINGS' PATENT MICRO-TELEPHONE TRANSMITTERS,
VYLE'S PATENT EASILY-TESTED LIGHTNING CONDUCTORS.

FOR SALE.

THE UNEXPIRED LEASE OF 16 YEARS OF PREMISES

(A PORTION OF WHICH IS LET OFF FOR £200 PER ANNUM),

WITH

PLANT consisting of FIXED MACHINERY, &c.,

Some of which is admirably adapted for DYNAMO MACHINE CONSTRUCTION.

A GOOD BUSINESS (Engineering), established in 1870, and still attached, might be worked additionally. Apply to "X. Y. Z.," care of Proprietor ELECTRICAL REVIEW, 22, Paternoster Row, E.C.

HATTON GARDEN, HOLBORN.

TO ELECTRIC, TELEPHONE, AND SCREW MANUFACTURING COMPANIES AND ENGINEERS.

Important Sale of Machinery, Plant, and Stock.

MR. ALFRED WATSON will SELL by AUCTION, upon the Premises, COLONIAL BUILDINGS, 59 and 61, HATTON GARDEN, on WEDNESDAY, AUGUST 9th, at Twelve precisely, in Lots, to suit the trade and private buyers, the whole of the

VALUABLE MACHINERY, PLANT, AND STOCK

of a manufacturing firm, as above, including an 8 horse-power Otto Gas Engine, by Crossley Bros., 13 French Screw Machines, five Drilling Machines, two Polishing Machines, two Screw Cutting Lathes, Drilling, Tapping, and Slotting Machines, seven Brass Finishing Lathes, two French Finishing Machines, four large French Presses, and 13 English ditto; Belting, Shafting, Vices, Tools, about seven tons of Brass and Iron Wire, several cwt. of Screws, and general effects.

May be viewed day prior and morning of Sale, and descriptive catalogues obtained of the Auctioneer, 60, Queen Victoria Street, London, E.C.

The Lease is to be Sold.

THE TELEGRAPHIC JOURNAL AND ELECTRICAL REVIEW.

Published every SATURDAY, Price 4d.

HAUGHTON & CO., 10, PATERNOSTER ROW, LONDON.

GENTLEMEN desirous of having the above Journal forwarded to them regularly, can have it sent by post on filling up this form and returning it to the Publishers, 10, PATERNOSTER ROW, LONDON, E.C.

Please supply me with "The Telegraphic Journal and Electrical Review," for which I inclose Post Office Order for.....

Name.....

Address.....

Date.....

P.O. Orders to be made payable to HAUGHTON & CO., at the Chief Office.

SUBSCRIPTION RATES.

IN GREAT BRITAIN, post free, per year, 19s. 6d.; per Half Year, 9s. 9d. To all Foreign Countries (except those mentioned below), per Year, £1 1s. 8d.; per Half Year, 10s. 10d.

EXCEPTIONS.—Abyssinia, Aden, Borneo, Ceylon, India, Java, Labuan, Mosambique, Penang, Persia, via Brindisi, Philippine Islands, Singapore, Zanzibar, to which the rates are: Per Year, £1 3s. 10d.; per Half Year, 11s. 11d.

VOL. X., Bound, is NOW READY. Price, 15s.

Volumes I., II., V., VI., VII., VIII., IX., and X., can be had bound in black cloth, gilt, at 15s. each volume.

A few Complete Sets of Volumes may be had. Price £7 10s. per set.

BINDING.—Subscribers' numbers bound for 3s. 6d. each volume, including case.

CASES.—Cloth Cases for Binding can be had, price 2s. 6d. each.

W. M. FOXCROFT

(SUCCESSOR TO THE LATE W. FOXCROFT),

TELEGRAPH CASE MANUFACTURER,

By Appointment to Her Majesty's Government and the Principal Railway and Telegraph Companies,

54, COMPTON STREET, CLERKENWELL, E.C.

ESTABLISHED 1844.



THE CHEAPEST HOUSE IN THE TRADE FOR THE MANUFACTURE OF TELEGRAPHIC CABINET WORK, BOTH BY HAND AND MACHINERY.

Prize Medal International Electrical Exhibition, Paris, 1881. The only Medal Awarded for Cabinet Work.

NEWALL'S PATENT LIGHTNING CONDUCTORS.

As applied to all kinds of Buildings and Shipping in all parts of the world with unvarying success, are the most reliable, most effective, and cheapest conductors offered to the public.

SOLE PATENTEES OF UNTWISTED WIRE ROPE.

Manufacturers of Iron and Steel Ropes for Colliery and Railway Purposes, Rigging Ropes, Guide Ropes, Flexible Steel Towing Hawsers, &c.

COPPER ROPE CABLES OF HIGH CONDUCTIVITY FOR ELECTRIC LIGHT AND POWER.

GALVANISED SIGNAL AND FENCING STRAND. GILT AND SILVER CORD FOR HANGING PICTURES. IRON, STEEL, AND COPPER CORD FOR CLOCK AND SASH LINES, &c.

R. S. NEWALL & CO., LONDON, 130, STRAND, W.C.

LIVERPOOL, 36, Waterloo Road; GLASGOW, 68, Anderston Quay; MANUFACTORY, Gateshead-on-Tyne.

THE BARNEY TELEPHONE,
HAVING TWO FLEXIBLE HEARING TUBES.**LOUD AND DISTINCT.**

THE BARNEY TRANSMITTER SHARP AND CLEAR. NO SINGING.

COMBINED TRANSMITTER WITH TELEPHONE, £10.

CAUTION TO PURCHASERS.—A Certificate that the Royalty has been paid, signed by W. C. BARNEY, must be affixed to each instrument.

EXCLUSIVE RIGHTS FOR DISTRICTS FOR SALE.

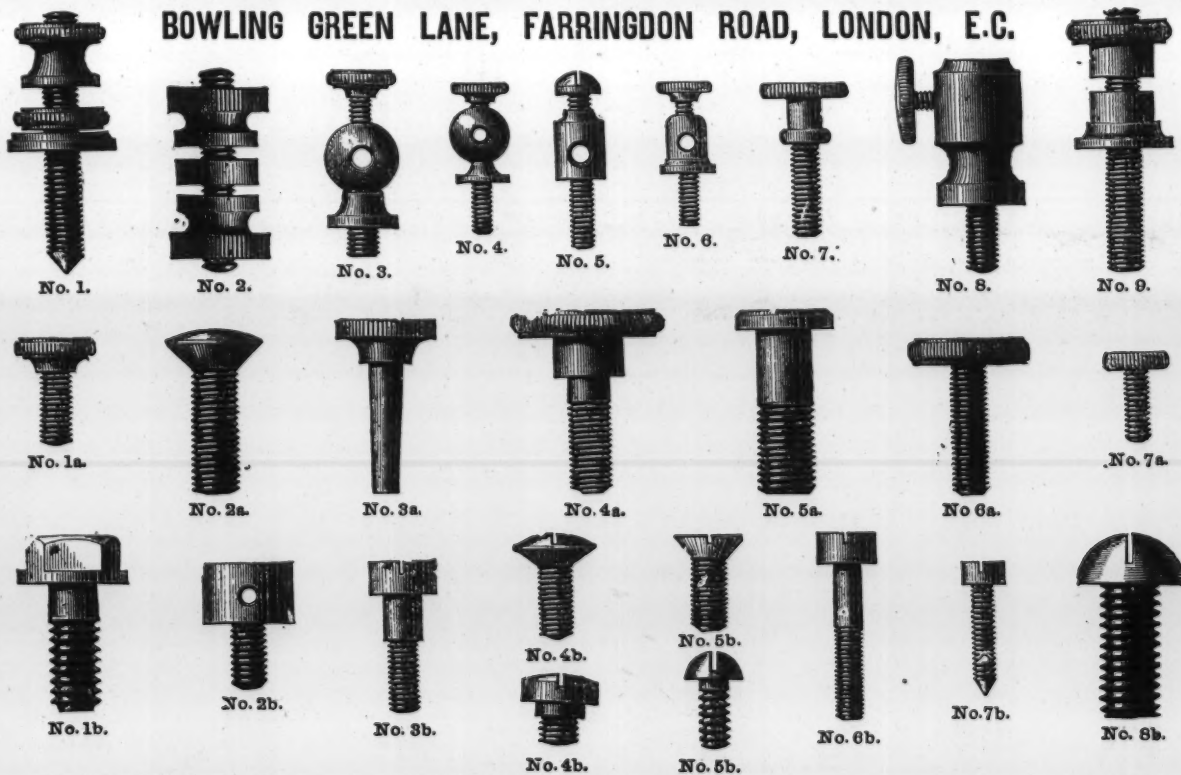
Apply to W. C. Barney, 53, Bernard Street, Russell Square.

THESE TELEPHONES CAN BE SEEN IN OPERATION AT 31, GOLDEN SQUARE, W.

DAVIS & TIMMINS,

Metal Screw Manufacturers,

BOWLING GREEN LANE, FARRINGTON ROAD, LONDON, E.C.



Binders, Terminals, Clamps, &c., kept in Stock. Estimates for Screws and Turned Parts on application.

EDWARD PATERSON, TELEGRAPH & ELECTRICAL ENGINEER,

St. Paul's Works—78, LITTLE BRITAIN, LONDON, E.C.,

AND

European Telegraph Works—POWNALL ROAD, DALSTON.

PARIS AGENTS—E. & G. DELEVINGNE, 6, RUE MARTEL, PARIS.

First Medal, International Electrical Exhibition, Paris, 1889.

MANUFACTURERS OF

Telephones, Transmitters, Switchboards,

AND ALL ACCESSORIES FOR

TELEPHONE EXCHANGES.

Electric Signals for Mines, Houses, Ships, &c. Black and Red Instruments for Railways.

Silk and Cotton covered Wires; Rubber covered Wires for Marine Signals; Electric Light Leads.

THE DOUBLE INDUCTION MOTOR FOR SEWING MACHINES, &c.

Batteries, Insulators, and other Telegraph Stores. Continuous Copper Band Lightning Conductors.

AYRTON & PERRY'S

Instruments for Electric Light
Measurements.

Ammeter.

Ohmmeter.

Voltmeter.

Electric Power Meter.



AYRTON & PERRY'S

Dynamometer Coupling.

Dispersion Photometer.

THE GOWER-BELL

LOUD SPEAKING TELEPHONE.

*As adopted by
Her Majesty's Government.*

ELECTRIC LIGHT LEADS, GUTTA-PERCHA, INDIA-RUBBER, COMPOUND BRAIDED
COTTON, SILK COVERED WIRES.

SPECIAL WIRES FOR DYNAMO MACHINES.

PHILLIPS BROS.,
ELECTRICAL WIRE MANUFACTURERS,
MACINTOSH LANE, HOMERTON,
LONDON.

ESTABLISHED 1870.]

SPECIAL WIRES FOR INCANDESCENT LAMPS.

GERMAN SILVER WIRES FOR HIGH RESISTANCES, FLEXIBLE CORDS, TELEPHONE
WIRES, &c., &c. MULTIPLE, AERIAL, AND SUBTERRANEAN CABLE WIRES TO
ANY SPECIFICATION.

